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WORKSHOP REPORT:

Assessment of Mathematics

And Science in Africa

(AMASA)

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EXECUTIVE SUMMARY

The objective of the AMASA workshop was to initiate dialogue among the participants how to promote effective teaching and learning of Mathematics and Science in Africa. To generate discussions, the delegates were given an opportunity to make presentations on various aspects of education in Africa focussing on the following key areas:

- Teacher education
- Curriculum development and
- Systemic assessment for policy planning, implementation and management.

Following country presentations, the participants convened into four groups to interrogate issues raised in the presentations. Their mandate was both to raise questions and articulate possible solutions to:

- Assessment systems and practices
- Teacher development and support
- Curriculum development and support and
- Systems change.

Following robust interactions on the issues alluded to above concrete positions emerged on how assessment initiatives in Mathematics and Science Education in various parts of Africa should be addressed. Participants of the workshop affirmed AMASA as an initiative aimed at the promotion of Mathematics and Science education in Africa by building upon the work already done and currently underway. This initiative also aims to maximise the utilisation of existing assessment expertise in Africa and reinforce assessment capacities in relevant institutions involved in examinations, teacher development, curriculum development, national surveys and studies and improvement of teacher skills.

As a consequence of the dialogue the participants unanimously adopted the following recommendations:

- Hold joint training workshops in advance data analysis for MLA and SACMEQ participating countries;
- Support the implementation of MLA II for Grades 8 and 9 for 2000 in Mathematics and Science with Life Skills in selected African countries;
- Finalize the report writing for SACMEQ II in the respective countries in 2002;
- Present and publish the evaluation report for MINEDAF in December 2002;
- Conduct regional workshops relevant to promoting the AMASA initiative;
- Produce training materials for educators and education officials;
- Organise training through attachment and exchange programmes using regional expertise;
- Initiating a Masters programmes for examination officers in collaboration with regional institutions;

- Organise training of examination setters, moderators and markers in collaboration with regional Examination Boards;
 - Organise training of Mathematics and Science teachers in principles of good assessment practices;
 - Review the impact of the existing Primary Science Examination Network;
 - Expand and convert the manual item banks into CD ROMs, and
 - Set up a Website to serve as an accessible database for all relevant AMASA information.
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1 WELCOME REMARKS: Dr Anil Kanjee

Dr Kanjee welcomed all participants and delegates to the AMASA Planning Workshop and thanked Drs F. Chung and V. Chinapah for initiating and funding the meeting. He stressed the importance of the meeting towards addressing the many challenges facing the mathematics and science education sector in Africa and invited all participants to make the most of this unique opportunity for contributing and sharing their experiences with each other, and wished the participants a pleasant stay and fruitful deliberations for the coming days.

2 OVERVIEW OF THE WORKSHOP: Dr Fay Chung

Dr F. Chung gave an overview of the Assessment of Mathematics and Science in Africa (AMASA) project, initiated by the International Institute for Capacity Building in Africa (IICBA) and UNESCO's office for Monitoring Quality Education. This project aims to develop and share capacity in three key areas:

- Teacher education;
- Curriculum development and
- Systemic assessment for policy planning, implementation and management.

She also outlined the following workshop objectives:

- Facilitate the exchange of information among participants on the status of mathematics and science education in the sub-region as well as the various initiatives underway;
- Utilize the capacities and experiences already gained in Africa, through the various projects and initiatives that have been completed or are currently being implemented;
- Attain some degree of cooperation and synergy between relevant organisations and projects focusing on the area of mathematics and science education in Africa;
- Analyse problems related to the relevancy of the maths and science curriculum to learners and communities in Africa;
- Explore new approaches to teaching mathematics and science that address specific needs of learners and communities;
- Identify systemic reforms that need to be addressed for the successful implementation of the project;

- Encourage an international, regional and national dynamic cooperation of relevant role-players in order to institute the identified reforms
- Identify mechanism of collective action to attract international funding support for improving mathematics and science teaching and learning process in Africa.

Dr Chung concluded by highlighting the specific relationships and links between the assessment system and practice, teacher development, and curriculum development, and noted the need to formulate a work-plan for developing relevant and appropriate assessment systems in participating countries. This work-plan will comprise detailed information on:

- The specific assessment issues/problems to be addressed and how this impacts on teacher development and curriculum development,
 - A strategy for addressing the issues/problems identified,
 - Estimated time frames for implementation,
 - Possible sources of funding,
 - Methods of coordination and cooperation between participating countries and
 - Developing mechanisms for maintaining a high level of interest and participation in the project.
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3 INVITED PRESENTATIONS AND DISCUSSION

Following Dr Chung's opening address, the invited participants made the following presentations:

3.1 Quality Education For All – UNESCO Position Paper

Prof V. Chinapah outlined the critical issues needed to be addressed for translating UNESCO's campaign on *Quality Education For All* for the millennium into reality. He cited the following characteristics to be pertinent to quality education:

- Quality education must be geared to enhancing each individual's potential and the full development of the learner's personality.
- Quality education should treat quality from the standpoint of the learners, the teachers, their learning environments, the learning structures, methods and contents, the teaching-learning processes and learning outcomes.
- Success of quality education requires genuine broad-based partnership of major education and education-related stakeholders.

Quality education as "A Shared Collective Vision" should be underpinned by:

- Public responsibility
- Interdisciplinary Imperatives at all levels
- Meet goals of the 21st Century

- Quality and relevance as inseparable but flexible entities
- Learner centered pedagogy
- Effective partnership in Educational Management and Leadership
- Measurement and Monitoring of Learning Outcomes.

He identified what he termed a framework for action under Five Challenges To Quality Education, namely:

- The knowledge challenge
- The challenge of decentralisation
- The resource challenge
- The challenge of social inclusion and
- The challenge of data and comparability

These challenges have to be understood within a particular Conceptual Framework that strives to formulate educational quality indicators. The conceptual framework that he recommends is the Input-Process- Output Model that embraces the following critical educational quality indicators:

- Educational policy indicators
- Home and community indicators
- School and classroom indicators and learning outcomes indicators.

Professor Chinapah called on participating delegates and countries to engender a Monitoring Culture that would promote at regional and national levels the following:

- Capacity searching
- Capacity sharing
- Capacity sustaining and
- Capacity strengthening.

He argued that this has to be underpinned by a plausible implementation strategy that would yield the following possibilities:

- To establish a system for monitoring the quality of basic educational programmes on a continuous and permanent basis.
- To periodically undertake assessment of learning outcomes and to provide an information-base for policy interventions for reducing between- and within- school disparities in learning outcomes that are due to for example, regional, gender and socio-economic differences.
- To nationally establish common minimum mastery level as well as desired mastery level of learning.
- To develop methods and indicators for long term monitoring in order to assist national policies for a Quality Education for All.

- Prof Chinapah concluded by noting the milestones already achieved through the MLA1 and 2 and the work that still lies ahead. He also commented on the role that UNESCO in partnership with other donor agencies and the need for further funding for the AMASA initiative.

3.2 Indigenous Knowledge Systems (IKS)

The presentation by Prof C. Odora-Hoppers focused on the “fit” between Indigenous Knowledge Systems (IKS) and the current educational systems and practices in Africa. She pointed out the lack of synergy between educational systems and local context. She argued that the majority of educational systems and curricula in Africa are underpinned by Euro-centricism particularly on knowledge construction and application. Western knowledge lacks a cosmological connectedness with nature and moral/ethical restraint.

Prof Odora-Hoppers argued that IKS as a system needs to be given prominence by addressing both ethical and strategic question on knowledge generation and legitimation thus interrogating the possible link between epistemology, diversity and democracy. She argued that it is through questioning that as nations we begin to understand and acknowledge the indigenous intellectual property of IKS. She concluded by noting the need to diversify African curricula by infusing the critical aspects of IKS, particularly the need to diversify the teaching and assessment of mathematics and science through indigenous knowledge.

3.3 Examinations For Innovation the role of African Forum for Children’s Literacy in Science and Technology (AFCLIST)

The presentation by Dr P. Naidoo and Prof M. Savage explored possibilities of promoting quality and relevant science and technology literacy and education among children and youth in Africa. They argue that “the science that AFCLIST promotes is inquiry science or mindset of the knowledge production processes of science and technology that young people of the continent must learn if Africa is to leapfrog from the rural into the global village”.

They also noted that the knowledge production approach of science and technology that AFCLIST promotes is underpinned by the principles of:

- Relevancy
- Economic feasibility, and
- Cultural appropriateness.

The presenters also highlighted the need for a Systemic Science and Technology Reform to address the dysfunctional science and technology programmes currently offered in sub-Saharan Africa. To accelerate systemic change with regard to the status of mathematics and science education in Africa, there is need for a

deeper understanding of the contextual variables and their impact on learner performance, especially in mathematics and science. These include the following:

- The context of classrooms
- The context of schools
- The context of the local community
- The context of the education system
- The context of the society etc.

They argued for the need to develop conceptual tools that will enhance the status of mathematics and science education in Africa and thus for research as a pivotal strategy for realising this challenge. They concluded their presentation by reflecting on AFCLIST's milestones over decades in various parts of Africa and challenged the participants to interrogate within the context of mathematics and science education in Africa the following:

- Assessment and examination in systemic change
- Precedents of more appropriate examinations
- Item design and development and
- Forces of change.

Dr P. Naidoo and Prof M. Savage concluded their presentation by reiterating AFCLIST's commitment to capacity building through its various programmes and partnerships and support for the AMASA initiative

3.4 Latin American Educational Quality Assessment Laboratory

Dr J. Formmel's presentation focused on educational changes taking place in Latin America and the Caribbean. He argued that the focus of these changes is the improvement of quality and equity of education. This, he noted required the adoption of methodologies that enabled education planners to discern with clarity the processes and results so far achieved by the school system. Furthermore, assessment thus becomes pivotal in policy formulation, tracking and implementation of education policy.

He argued that the Latin American Educational Quality Assessment Laboratory as a commissioned UNESCO study provides us with valuable information and data on educational achievements of Argentina, Bolivia, Brazil, Chile, Colombia, Cuba, Honduras, Mexico, Paraguay, The Dominican Republic and Venezuela. It further provides data stratified by demographic differentiations (large cities, urban and rural) and by the type of school administration (private and public).

He concluded that although these studies give us an insight into the dynamics of assessment of learner

performance in mathematics and science in the Latin American countries, there is need for longitudinal studies to track down the envisaged educational changes. This he suggested could be achieved through inter-regional alliances and partnerships.

3.5 Science Education Policy and Assessment in Africa: Revisiting some Issues

Drs K. Lewin and U. Bude's presentation focused on curriculum and policy initiatives currently implemented in some of the African countries. Dr Bude gave a synopsis of the work they have done in Africa on assessment. He emphasized the need to diversify assessment strategies within countries and schools in particular. He argued that a lot of work has to be done to change the mindset of stakeholders in education regarding perceptions about examinations. He stressed that examinations will always be part of an educational system. It is how that particular system employs them that becomes contentious.

He further argued that the subject of contention is often the quality of questions in formal examinations. He argued that item development is a plausible strategy to address such defects. He recommended the following:

- Review of existing item banks to address the current learner needs particularly in mathematics and science education
- Strengthening of dialogue among item developers on an array of aspects of the examination papers
- Strengthening of item peer review to enhance quality and relevance
- Use of research to inform assessment initiatives
- Strengthening of professional linkages between organisations and researchers
- Inclusion of assessment as component of teacher training
- Need to promote and sustain the work that Bude and Lewin initiated.

Dr Lewin focused more on policy changes in Africa especially with regard to assessment of mathematics and science education. He went on to deliberate on the social dynamics of examinations between the developing and developed nations. He argued that globalisation has impacted significantly on the typology of institutions and the type of examinations and assessment strategies used to select learners for further education. He argued that as nations ponder about assessment initiatives, they should not ignore their contextual circumstances. He made the following suggestions:

- Need to interrogate assessment initiatives within the global context
- Need to conceptualise education as a social development
- Strengthen delivery of services
- Strengthen internal assessment standards
- Forge partnerships with regional and international associations
- Strengthen research input

- Strengthen the use of continuous assessment, etc.

3.6 Maths, Science and Technology Education in South Africa

Dr C.R. Lubisi's presentation outlined the history of education in South Africa from the apartheid era to the new dispensation. He reported that prior to 1994 South Africa had 19 different departments of education based on racial and ethnic lines. He conceded that apartheid education prepared learners for different roles and compounded social inequality between racial groups. This he argued led to 1976 upheavals and subsequent school boycotts during the 1980's and early 1990's.

He reported that when the democratic government assumed power after the 1994 elections, tangible changes were initiated. He argued that the adoption of the National Qualifications Framework and Outcomes Based Education was a huge paradigm shift. The South Africa Qualifications Authority (SAQA) was also established to develop and maintain an effective qualification framework that would serve all sectors of education and training.

In terms of the NQF, education and training was divided into three broad educational bands:

- General education and training
- Further education and training
- Higher education and training

He also reported that more robust curriculum introspection was initiated through the National Education and Training Forum. Its mandate was to review the syllabus and rationalise subjects to form a single national core syllabus. Curriculum 2005 was the first major curriculum initiative borne of the democratic processes in South Africa and was introduced into schools in 1998.

As a consequence of implementation problems experienced at school level, Curriculum 2005 was subsequently reviewed in 2000 to assess its:

- Structure and design
- Teacher development processes
- Learning materials
- Provincial support to teachers in schools
- Implementation timeframes

He reported that the Review Committee recommended for the streamlining of Curriculum 2005. He concluded by stating that examination and assessment practices are being reviewed to address some of the

problems alluded to in the presentation. He further conceded that a lot of work lies ahead regarding the status of mathematics and science education and assessment practices that project authentic learner performance across the curriculum.

4 COUNTRY PRESENTATIONS

The second phase of presentations focused on the strategies employed by African countries to improve learner performance in mathematics and science. Delegates from participating countries presented the following reports:

4.1 Examination Council of Zambia: Activities involving Mathematics and Science at school level

In her presentation, Ms M.G. Mulenga gave a brief background about the Zambian Basic School Education. She stated that the Basic School Education comprised three phases:

- Lower basic (grades 1 to 4)
- Middle basic (grades 5 to 7)
- Upper basic (grades 8 to 9).

She indicated that the Senior Secondary Education phase is a 3 year programme that covers grades 10 to 12. The composition of the subjects taught at this level include:

- Languages
- Social sciences
- Sciences
- Commercial subjects
- Other (vocational).

She indicated that pupils sit for public Examinations at grades 7, 9 and 12 and the Examination Council of Zambia is responsible for examinations.

She furthermore, outlined the various activities and interventions taking place in Zambia towards the improvement of the teaching and learning of mathematics and science and these include:

- The AIMES project- through this project various teacher centres were set up in all districts to build teacher capacity in maths and science including material production.
- Female Education in Mathematics and Science in Africa (FEMSA)- All FEMSA projects are taking place at school level and are intended to improve girls' participation and performance in Mathematics and Science.

- **Zambia National Assessment** – this was a survey study conducted by the Examinations Council of Zambia on the learning achievements at grade 5 in English, Mathematics and a Zambian language. The purpose of the national survey was to establish the baseline information on Learning Achievements and its correlates. The results showed that the learning levels were very low for both maths and science.

To address some of the problems alluded to above, the following intervention measures have been introduced:

- **Grade 4 Basic Competences Tests in literacy and Numeracy** – to measure the minimum basic abilities in reading, writing, numeracy, listening and speaking.
- **JET Clubs**- to encourage learner creativity and participation in project related activities that can be displayed at the maths and science fair.

She concluded her presentation by intimating that there is still a lot of work to be done to improve the assessment techniques in mathematics and science in Zambia.

4.2 The Current Situation in Swaziland on Curriculum Development and Assessment Studies

In her presentation Ms J.G. Fakudze indicated that as an education provider her unit conducts various workshops to empower teachers on the assessment of mathematics and science at primary level. They also assist towards the infusion of new curriculum materials developed by the National Curriculum Centre (NCC). She further intimated that tangible changes too have been effected in terms of how the Primary School Leaving Examinations. The setting of examination papers is the responsibility of a committee consisting of co-opted members from NCC, INSET, TTC, UNISWA and regional representative teachers.

She also indicted that attempts are underway to expand the item bank system that has just been started. Continuous Assessment has also been introduced as an integral part of teaching and learning to reduce wastage, repetition and drop out rate. This is further strengthened by the adoption of a National Assessment Framework for grades 1 to 10 whose objectives are:

- To assist in the development of a coherent and systematic assessment policies and practice in the schools.
- To achieve on a national basis clearer definition of structure, objectives and balance of curriculum.
- To achieve better communication with parents and better reporting on pupil progress.

She concluded her presentation by stating that Swaziland is involved in two mini research studies funded by AFCLIST namely:

- Developing teaching/learning strategies to minimise problems in acquiring scientific process skill and

high order reasoning.

- Documenting scientific process and concepts found in Swaziland manufacturing industries.

She further conceded that there is still more work to be done to improve the status of mathematics and science education in Swaziland at the primary level of the education system.

4.3 Improving the Primary Science Examinations

Mr J. Mwanza and Mr M. Jere's presentation outlined some pertinent changes taking place within the Malawi National Examination. Over the past two years, the Malawi National Examinations Board (MNEB) with funding from AFCLIST has embarked on the following strategies to improve primary science examinations:

- Training of teacher trainers in ways of developing meaningful test items that test higher order cognitive abilities
- Inclusion of higher order test items in the examination.

They reported that the pilot study "Towards Examination Reform: A comparison of School Assessment and Assessment by the Malawi National Examination Board (MANEB)" identified various weaknesses in the assessment instruments use by schools and MANEB. Analysis of school based and MANEB tests showed unacceptably high percentage of recall type of test items. The science MANEB paper comprised 81% recall items and the school's tests had recall items ranging from 71-95%. The pilot study also confirmed that the quality of test items was poor. The test items did not test learner's understanding of principles and concepts, application of scientific knowledge, interpreting, analysing, synthesizing and evaluating scientific information.

Another crucial observation was the differential item functioning in these assessment tools between groups of learners. Girls and urban pupils appeared to be grossly disadvantaged. He indicated that some of these defects are being addressed by training item writers in the techniques of writing higher order items and sensitising them to the various types of biases that items can bring to bear on certain groups of learners if special care is not taken during item construction.

The Malawi National Examinations Board and Chancellor College facilitated the training and the following areas were covered:

- General principles of test construction
- Principles of writing objective items
- Principles of writing higher order test items
- Evaluating test items using item analysis techniques.

The presenters also reported that items were pre-tested in a sample of schools across the country and item analysis carried out on learner's performance. This process provided additional information for determining the complexity of the items. Regarding differential item functioning between boys and girls, the latter obtained lower scores than boys in 61 of the 70 items and outperformed boys only in 8 items. They concluded the presentation by suggesting the need for a more controlled research to make firm conclusions about the status of maths and science in Malawi.

4.4 Assessment of Mathematics and Science: Tanzania experience

Mr C.H. Mbiku introduced his presentation with a brief overview of the current structure of formal schooling in Tanzania, which comprises 7 years of primary education, 4 years of ordinary level secondary education and 2 years of advanced level secondary education followed by a minimum of 3 years of university education.

Commenting on the Tanzanian Examination System, he reported that through an Act of Parliament, the National Examinations Council of Tanzania (NECTA) was established in 1973 with the following mandate:

- Formulate examinations policy in accordance with the principles of education for self-reliance and education and training policy;
- Assume responsibility for examinations within the United Republic of Tanzania and make provision for places and centres of examinations;
- Conduct examinations for and grant diplomas, certificates and other awards of the council.

This mandate is underpinned by a bold mission statement namely “*To contribute to national development through fair, efficient and effective national examinations and educational assessment systems that provide high quality stakeholders service through competent and motivated staff*”. He indicated that NECTA conducts and administers examinations by convening subject panel meetings to draft examination guidelines that include examination formats, tests and blue prints. The examination formats are then presented to the relevant Examination Committee for scrutiny and approval.

He also reported that the selection of setters is done by the NECTA. Following poor learner performance in maths and science education, the Tanzanian government has reintroduced science “practicals” as a component of the National Examination. Regarding the alignment of syllabus with examination requirements, the National Examination Council through the directive of the Commissioner of Education introduces the envisaged syllabus changes. Furthermore, Continuous Assessment has now been formalised as an integral component of the education system.

He concluded the presentation by reflecting on the following factors that contribute to learners' poor performance in maths and science education:

- Shortage of teachers qualified in the teaching of maths and science
- Shortage of teaching aids
- Inadequate mathematical and scientific knowledge among teachers
- Lack of teacher's seminars
- Learners' negative attitude towards maths and science
- The tuition syndrome
- Lack of enough maths exercises and science demonstrations from subject teachers.

To address some of these challenges the following changes have been effected:

- The Primary curriculum has been reduced from 13 subjects to 7 with emphasis on Maths, Science, English, Kiswahili, Life Skills, General knowledge.
- A number of teacher development programmes have been developed to enhance the situation.

4.5 Mathematics and Science Education in Kenya: Current Issues

A presentation by Mr P.M. Wasanga and Ms J. Nzomo explored the envisaged structural transformation of Kenya into an industrialized country in 2020. The current national development plan (1997-2001) views industrialization as a plausible strategy for achieving rapid and sustained development. It also acknowledges the need to diversify education and training by empowering the human resources with appropriate scientific skills.

They argued that for Kenya to realise industrial growth and development Mathematics, Science and Information Technology are crucial and have to be introduced in the school curriculum. Candidates' performance in maths and science needs to be improved and sustained. An examination of candidates' performance in mathematics and science in Kenya in 1999 and 2000 highlighted the poor results relative to subject areas.

They reported that several initiatives aimed at improving learner performance in mathematics and science have been undertaken. For instance, the Strengthening of Mathematics and Sciences in Secondary Education (SMASSE) Project, a joint collaboration between the Kenyan government and the Japanese International Co-operation Agency (JICA) was launched in 1998 in 9 districts, with the following objectives:

- Enhance capabilities of Mathematics and Science teachers in districts in terms of teaching methods, knowledge level and management of experimental equipment in Science and Maths.

- Enhancement of frequent and regular interaction among Science and Maths teachers.
- Establishment and institutionalisation of regularised In-service of teachers for Science and Maths teachers in districts.
- Improvement of the trainees' ability and skills in resource management, teaching approaches and strategies. And consequently strengthening of Maths and Science at Secondary level.

The other initiative intended at improving Maths and Science education is the Female Participation and Performance in Mathematics and Science that was launched in 2000. The main purpose was to attract funding for improving the participation and performance in the area of Science and Information Technology.

The presenters concluded by highlighting some of the following factors that influence the performance of girls in Mathematics and Science:

- Lack of role models
- Low qualification of teacher trainees in Maths and Science
- Teaching and learning resources
- Teaching methods
- Cost of education
- Teachers' attitudes
- Parental attitudes
- Girls' attitudes towards science subjects

To address the above problems the Ministry of Education, Science and Technology in collaboration with FEMSA and other funding agencies has embarked on Curriculum Review to address some of these challenges

4.6 Research and Curriculum Activities in Botswana

In his presentation, Dr C. Cele gave a brief history of education in Botswana since independence and highlighted the current educational changes initiated by the Botswana government through a plethora of National Developmental Plans. He conceded, however, that Botswana, like her regional counterparts has serious educational problems and challenges and singled out the status of mathematics and science education as a huge challenge.

Dr Cele commended the Botswana government for being pro-active and committed to the ideal of quality education for all. This, he argued, is demonstrated by Botswana's involvement in the UNESCO's commissioned projects and studies such as MLA, SACMEQ and TIMSS. He further conceded that Botswana

as a nation had not fully mastered the diverse assessment paradigms in education. He argued that the current assessment frameworks and strategies do not adequately provide authentic information about learner capabilities in mathematics and science education and noted that other contextual factors have also compounded the situation.

He concluded the presentation by indicating that the Botswana Ministry of Education has initiated Curriculum Reform that include:

- Diversification of the curricula to include Life Skills and other related subjects
- Review of existing syllabuses, especially at the lower primary and
- Development of maths and science syllabus to be implemented in 2002.

He encouraged the regional countries to collaborate on a wide range of initiatives that will enhance the provision and quality of education in Africa.

4.7 The Role of SACMEQ

The presentation by Mr. S. Murimba focused on the role and obligations of SACMEQ towards the promotion of quality education in Africa. He argued that SACMEQ's mission is two pronged, to:

- Train educational planners with technical skills relevant to their ministerial responsibilities.
- Conduct research to generate data for decision makers to use and plan educational initiatives.

He reported that SACMEQ subscribed an educational approach based on partnerships and collaborations and highlighted the following milestones that SACMEQ has so far achieved:

- An increase in membership from 7 to 15;
- Production and publication of various country reports;
- Provision of relevant training to the Ministry of Education staff;
- Establishment of SACMEQ data archive.

The following were highlighted as the major challenges faced by SACMEQ:

- The challenge of expansion
- Mobility and attrition of SACMEQ researchers
- Institutionalisation of SACMEQ
- Funding
- Building institutional capacity in teacher development, curriculum development and assessment.

Mr Murimba concluded by stating that SACMEQ will continue to collaborate with other associations in the

region on a range of initiatives that promote quality education and practices in Africa. In particular, they recommended a closer collaboration with Monitoring Learning Achievement project to promote capacity sharing and effective use of expertise available in Africa.

4.8 The Achievements of Primary School Pupils in Uganda in Mathematics: 1999 National Assessment of Progress Education Study

In their presentation Mr D.N. Odongo and Mr A.K. Byamugisha gave a brief history of education in Uganda and noted the various levels at which learners sit for achievement examination. The results are used for certification and selection for post primary institutions. They also reported about the changes that were effected to provide more meaningful and quality assessment strategies that reflect the aspirations of Uganda nation. To achieve this challenge, the Uganda National Examinations Board (UNEB) embarked on Assessment Reform that included:

- Improvement of the quality of existing examinations
- Introduction of Continuous Assessment in primary schools
- National Assessment of Progress in Education (NAPE)

They further noted that the establishment of NAPE was crucial in determining learners' performance across time and discipline. It provided comprehensive and reliable data on the status of education. NAPE also provides valuable information on the impact of contextual factors on learner achievement.

They stated that NAPE monitors learner progress and performance at two crucial stages namely, the P3 class where many new concepts are introduced and P6 which is the year before learners sit for Primary Leaving Examination (PLE). This they argued benefits Uganda in two significant ways:

- Intervention programmes can be mounted early enough to enhance learner performance
- Creates possibilities to compare the NAPE results with the PLE results of the following year.

They reported on the 1999 Mathematics Assessment study at the P6 level and noted that the objectives of the study were to:

- Determine the level of pupils' achievement in mathematics
- Examine patterns of performance in components of mathematics achievements
- Examine relationship between achievements and location, region, age and gender
- Examine the association between achievements and a variety of school and background inputs
- Compare 1999 achievements with that of 1996.

They concluded by noting the following results of the study:

- Competencies in the various curricular areas varied widely,

- Boys performed better than girls in all curricular areas,
- Pupils in town schools obtained higher means scores compared to village schools, and
- encouraging greater regional collaborate on relevant assessment initiatives.

4.9 Educational Developments in Mozambique

Mr. R. Cossa's presentation focused on the history of education in Mozambique. He also gave a synopsis of the organisational structures within the Ministry of Education and schools and highlighted the negative impact of the war on the education system. He also reported that the status of mathematics and science education was currently under review. Commenting on Examinations and Assessment practices, Mr. Cossa indicated that continuous assessment has been introduced in schools as a strategy to monitor learner performance. He concluded his presentation by indicating that there were strategic plans to review and diversify curriculum to accommodate maths and science education as well as other disciplines.

4.10 Educational Changes in Namibia

Mr. J. Fransman's presentation began with brief outline of educational development in Namibia since independence and a synopsis of the current changes in education. He noted that Namibia, like her counterparts in the region, was also grappling with a plethora of educational challenges, particularly the status of mathematics and science education, and conceded that a great deal of work was required regarding the implementation of assessment strategies and practices in Namibian schools. He concluded by stating that major curriculum changes were under way to address the problems alluded to in the presentation. He also called for greater regional collaboration on the various educational initiatives.

5 WORKING GROUP SESSIONS/REPORT BACKS

Following country presentations, the delegates were grouped into four working group/plenary sessions:

- Assessment systems and practice
- Teacher development and support
- Curriculum development and support and
- Systems change.

Each group had a set of critical questions to interrogate and report back to other delegates. Following robust dialogue and debate within the working group and plenary sessions, consensus was reached on the following:

Assessment systems and practices

The general consensus was that assessment was used in most countries as an official tool for selection and certification of learners in education. The group conceded that the current assessment practices failed to capture and monitor authentic learner achievement and performance across the curriculum. The group identified a number of problems related to assessment especially of Mathematics and Science:

- Inadequate assessment expertise in Maths and Science at school level
- Lack of clarity between curriculum objectives and assessment outcomes
- Poorly qualified teachers in Maths and Science
- Teachers' limited ability to interpret curriculum. etc.

To address some of these challenges, the group offered the following intervention strategies:

- Relevant training in education assessment
- Development and application of item banks
- Training in curriculum design and development
- Consolidation of organisational networks etc.

Teacher development and support

The group noted that teachers constitute one of the critical and essential inputs towards school improvement. As consequence of their crucial role, their academic and professional profiles play an important role in educational change and development. Likewise, the group also identified a plethora of challenges that schools needed to address to improve their assessment practices in Mathematics and Science:

- Lack of qualified Mathematics and Science teachers
- Lack of relevant content and professional skills among teachers
- Lack of assessment knowledge, skills and techniques
- Poorly resourced institutions of learning

The following intervention strategies were deemed plausible for adoption or implementation:

- Training in PRESET, INSET, and CPD
- Training attachment and exchange programmes
- Training in testing and assessment
- Workshops and seminars
- Consolidation of institutional networks etc.

Curriculum development and support

This group acknowledged that curriculum development and support was a complex and emotive process underpinned by notions of power relations. They conceded that it is quite often the nature of such power

relations that determines the extent to which curriculum initiatives are planned, developed and sustained. The group further acknowledged that curriculum constitutes the core of education and determines what learners learn at schools and the appropriateness of the content including the modalities of assessing learner achievement and performance. They also noted that in many African countries, the school curriculum is still, to a large extent, a replica of the colonialism system and fails to empower learners sufficiently.

The group noted the following problems regarding the status of curriculum with respect to Mathematics and Science:

- No effective linkage between curriculum and methodology
- Lack of expertise in curriculum design and development
- Shortage of teaching and learning resources
- Poor assessment strategies
- Lack of synergy between curriculum and learner/community needs
- Lack of synergy between teaching methodologies and assessment strategies etc.

The following intervention mechanisms were suggested to address the challenges identified:

- Training of teachers in curriculum development and assessment strategies
- Training examination officers and setters in assessment techniques
- Setting item banks
- Integration of Indigenous Knowledge Systems and Global trends into the curriculum
- Developing stronger affinity between school and community
- Use of relevant teaching and learning resources
- Workshops and seminars
- Institutional cooperation and collaboration etc.

Systems change

There was consensus among the group regarding the need implement changes to the system as well. Members of the group argued that system changes must ensure that policy makers understand the need for change and open up further avenues for professional development and capacity building. In their examination of Systems Change the group noted that the Assessment Systems currently used were limited as these systems focussed mainly on

- Selection for the next level
- Certification
- Ranking of schools
- Motivation for students and teachers
- Rewarding teachers

The group argued that a system ought:

- To facilitate effective teaching and learning
- Diagnosing and evaluating the extent to which the countries educational goals are being met
- Directing pupils into areas for further studies in order to fully develop them.

They also identified a range of problems related to system change namely:

- General fear for change
- Limited capacity to sustain change
- Shortage of relevant resources
- Lack of chasm between reality and the ideal situation
- Lack of foresight in policy planning and implementation

They further suggested the following intervention mechanism to improve the situation:

- Creating a conducive environment for exchange of ideas
- Improving capacity at systems level (e.g assessment techniques)
- Carrying out surveys that bring stakeholders into educational dialogue
- Governmental budgetary allocation and policy
- Sharing of resources at regional level
- Training in curriculum design and development
- Workshops and seminars
- Creating forums for dialogue on systems issues
- Establishing networks with other relevant organisations
- Providing technical assistance where needed.

6 CONCLUSION

Following the report back sessions, a further review of the issues raised in the plenary presentations was agreed upon and two working groups were charged with the responsibility of distilling group contributions into concrete and workable frameworks. The mandate of the working group was to make recommendations and formulate the way forward in the following two areas: Assessment Surveys and Studies, and Examination Systems

The reports of the working groups were discussed after which delegates resolved the following:

6.1 Definition of AMASA

AMASA is an initiative aimed at the promotion of mathematics and science education in Africa by building upon the work already done and currently underway. This initiative is primarily focussed at improving and strengthening

- National examination systems,
- National assessment surveys and studies

This initiative also aims to maximise the utilisation of existing assessment expertise in Africa and reinforce assessment capacities in relevant institutions involved in examinations, teacher development, curriculum development, national surveys and studies and improvement of teacher skills.

In order to attain these aims, there will be need to address the following:

- Assessment and Examination practices.
- Effective teaching and learning.
- Achievement of the countries educational goals and

The sharing of expertise and training opportunities (e.g. SACMEQ and MLA workshops) within the African continent

6.2 Assessment Surveys and Studies

The AMASA initiative should place a strong emphasis on the continuation and further development of national evaluation surveys and studies in Africa with respect to Mathematics and Science education. In order to realise this challenge the AMASA initiative should strengthen national capacities through:

- Implementing regular school surveys and case studies in Mathematics and Science education for informed decision making targeted at policy makers, planners, researchers, examination experts, school inspectors, teachers, parents, curriculum developers, teacher educators and civil society;
- Conducting relevant workshops and seminars designed to enhance the skills of targeted key players in education; and
- Sharing assessment experiences within the region by building networks of specialised groups.

Workshop delegates indicated that the challenges alluded to above should be addressed through the:

- Implementation of MLA II for Grades 8 and 9 for 2002 in Mathematics and Science with Life Skills in selected African countries;
- Finalising report writing for SACMEQ II in the respective countries in 2002;
- Planning a training workshop in advanced data analysis for MLA II and SACMEQ II in South Africa in November 2002 and
- Presenting and publishing the contents evaluation report for MINEDAF in December 2002.

6.3 Examination systems

With regard to examination systems, delegates noted the following possibilities for improving assessment and examination practices in Africa as and identified agencies for implementation:

1. Training of subject officers involved in mathematics and science
 - Short term training in assessment which is Board based
 - Conducting regional workshops
 - Production of training materials
 - Training through attachment and exchange programmes using expertise in the region
 - Masters programmes for examination officers

Responsible institutions: examination boards with the capacity and AMASA.

2. Training of setters, moderators and markers

Examination officers conduct training at Board and country level

Responsible institutions: examination boards with the capacity and AMASA.

3. Review of assessment objectives to make them explicit

The already trained examination officers hold workshops at Board level. AMASA to monitor by getting progress reports from examination officers. These can then be circulated to other examining boards.

Responsible institutions: examination boards with the capacity and AMASA.

4. Training of Mathematics and Science teachers in principles of good assessment practices

Examinations officers conduct training workshops, production of manuals and use of external expertise from the region where available.

5. Review of what has taken place with a focus on the work of the primary science examination network already in place. Discussions should focus on its impact and the way forward. To be coordinated by AMASA urgently.

6. Conversion of the manual item banks into CD ROMs and obtaining more questions from the AMASA group to expand the item bank for official circulation to the Boards in the region, coordinated by AMASA.

7. Website

There's need to establish a website that will serve as a database for all relevant information related required

to ensure that the AMASA initiative succeeds.

Responsible intuition: IICBA.

APPENDIX A: WORKSHOP OBJECTIVES

The primary objective of this workshop is to develop a workplan for instituting an assessment (includes testing) system that would support education policy planning, implementation and management in African countries.

To attain this objective, the aim of the planning workshop is to:

- facilitate the exchange of information among participants on the status of mathematics and science education in the sub-region as well as the various initiatives underway,
- utilize the capacities and experiences already gained in Africa, through the various projects and initiatives that have either been completed or are currently being implemented,
- attain some degree of co-operation and synergy between relevant organizations and projects focusing on the area of mathematics and science education in Africa,
- define the most relevant actions to be undertaken at the level of the region with appropriate sources of funding,
- analyse problems related to the relevancy of the maths and science curriculum to learners and communities in Africa,
- explore new approaches to teaching mathematics and science that address specific needs to learners and communities,
- identify systemic reforms that need to be addressed for the successful implementation of the project,
- encourage an international, regional and national dynamic co-operation of relevant roleplayers in order to institute the identified reforms,
- Identify mechanism of collective action to attract international funding support for improving the mathematics and science teaching and learning process in Africa.

EXPECTED OUTCOMES

The expected outcomes of this planning workshop include the following:

- A better understanding of the actual situation in sub-region regarding the status of mathematics and science education,
- Highlight the specific relationships and links between the assessment system and practice, teacher development and curriculum development,
- The formulation of a workplan for developing relevant and appropriate assessment systems in participating countries. This workplan should comprise detailed information on:
 - The specific assessment issues/problems to be addressed and how this impacts on teacher development and curriculum development,
 - A strategy for addressing the issues/problems identified,

- An estimated time frames for implementation,
- Possible sources of funding,
- Methods of co-ordination and co-operation between participating countries,
- Developing mechanisms for maintaining a high level of interest and participation in the project.

PROPOSED WORKING GROUP TOPICS

The proposed working groups topics focus specifically on mathematics and science education relevant to the junior secondary phase. However, it needs to be recognised that these issues comprise one aspect of a larger, complex education (as well as national and international) system and thus must be noted in this context. The four areas identified for this workshop are:

1. Assessment systems and practices

Assessment in education is generally used for ensuring accountability, for selection and certification as well as for monitoring and evaluation, and is central to any education system. This is especially relevant to periods of transition as well as when new policies or programs are implemented. A functioning and relevant assessment system in education provides appropriate information to all roleplayers (policy makers, researchers, parents, teachers, school principals and learners) regarding the strengths and weaknesses of the curriculum, the performance of learners and teachers, the usefulness of (current) policies and problems with specific intervention programs

The underlying idea is to allow African countries to measure their achievements regularly and in a professionally sound way, and to enable them to compare their achievements against their own past achievements and against the achievements of other countries in the region. Such an exercise would be a valuable instrument for raising the quality of mathematics and science in the region as it would help to identify specific strengths and weaknesses and provide information for the development and implementation of relevant intervention programs. It would also help to build the capacities of institutions in the region in the area of educational assessment of mathematics and science.

Some questions to address include:

- How should we define an assessment system? That is, what constitutes an assessment system?
- What is the role and use of assessment in education in general and maths and science education in particular?
- How do these roles and uses identified above manifest in practice?
- What is the impact of assessment and examination systems on mathematics and science in particular and secondary education in general?

- What are the specific links to teacher development and curriculum development?
- How can the present assessment (examinations) systems be transformed into an effective tool to improve the quality and relevance of mathematics and science education?
- What is it that needs to be changed/improved at the various levels of the systems to implement an effective assessment system?

2. Teacher development and support

Teachers comprise one of the most critical and essential inputs into improving education. The improvement of teachers' academic and professional skills and teaching methodologies is a priority of the IICBA. This will be accomplished through:

- Initiating distance education programs to train and Up-grade Teachers in Africa. Distance education will be developed as a special modality to be utilized to improve both accessibility and quality,
- Establishing Teacher education networks linking teacher education institutions to latest curriculum development initiatives,
- Improving teachers' access to knowledge base in areas of mathematics, science and technology by developing Electronic libraries.

Workshop questions

The task of this workgroup would be to ascertain the following with respect to mathematics and science education at the junior secondary level:

- What is the current status of teachers in the system at a national and sub-regional level with respect to their qualification and experience,
- What is the availability of teacher development programs?
- Do these programs adequately meet the needs of teachers and the system?
- What are the different roles and uses of assessment at the classroom, school, district/region and national levels?
- How do teachers use assessment for improving the teaching and learning process?
- How can the status of teachers be enhanced in communities?

3. Curriculum development and support

The curriculum comprises the core of education: it determines what children learn in schools, whether the content of education is up-to-date or archaic, whether the content of education is relevant to the real life situation of the learners and whether what children learn in school is preparing them for life in their own societies and for competition in the global economy of tomorrow. It can also determine whether children acquire democratic values and conflict resolution skills. In many African countries, the school curriculum at

primary and secondary school levels is still closely linked to the curriculum inherited from the colonial past. This curriculum may emphasize knowledge and skills that are more suited to the past than to the future, and may utilize a narrow range of teacher centred methodologies.

The IICBA has begun to establish a network of curriculum development institutions in Africa with the following objectives:

- Improve the curriculum in mathematics, language, science, and technology in primary and secondary schools. This includes improvement of the textbooks and of teaching methodologies used in schools, and the development of teaching and learning materials.
- Update teacher education curriculum in primary and secondary teacher training institutions.
- Provide training in curriculum development skills including textbook writing and the skills to develop teaching and learning materials.
- Establish electronic libraries to enable curriculum developers to be in touch with the latest research and development in their disciplines.
- Link teacher education institutions to the latest curriculum development work, nationally and internationally.
- Improve technology utilization in secondary schools and teachers' colleges, in particular updating in computer technology.
- Provide training and updating in the use of distance education methodologies for education, with particular emphasis on the use of information and communication technology (ICT).
- Unite curriculum development institutions Africa wide to each other and to key institutions internationally.
- Network with teachers' associations with the objective of ensuring that these associations focus on the improvements of the quality of the teaching and learning processes.

Workshop questions

Some of the issues to be addressed by the curriculum workgroup, focussing on mathematics and science at the junior secondary level include the following:

- What is the current status of the curriculum with respect to the teaching of mathematics and science?
- How relevant is the curriculum to the current needs of learners and communities?
- Does the curriculum highlight the linkages to assessment and how are these reflected?
- What kind of curriculum needs to be proposed that will reflect the local needs as well as modern trends in globalisation?
- How should teachers be trained in the delivery of new and relevant curricula?
- How can community involvement be enlisted in the delivery of curricula?

4. Systems change

For any intervention (or project) to succeed, permission and/or appropriate support from relevant institutions within the system must be available. However, in too many interventions, especially those where the goal is to improve the capacity of the system, there is an assumption that any change brought about from the intervention at the institutional level will result in corresponding changes at the systems level. This can only occur if objectives of interventions are targeted at both the institutional and systems level.

Workshop questions

The specific questions noted for this workshop must take into account the high degree of overlap with the other workshops. However, the focus, as far as it is possible, should be on mathematics and science education at the junior secondary level. Some of the questions to be addressed include the following:

- What are the specific characteristics of our education system that facilitate positive change?
- What are the specific characteristics of our education system that hinder positive change?
- What are the issues/problems specific to the system that impact on mathematics and science education?
- How can the AMASA project promote effective system change – both at a national and sub-regional level?
- What is the time frame for implementing the ideas identified?

CONCLUSION

This inter-relatedness and overlap among the different issues listed are a key feature of what characterises the daily practice relating to mathematics and science education, and thus should be taken into account in the different workgroups. However, to the extent possible, the key issues should be focussed on the topics listed for the different workgroups.

It must be noted that the questions noted and issues presented in this document are intended to serve as a basis for further discussion and to provide some direction towards attaining the objectives of the workshop. It must be stressed that any additional suggestions and ideas relevant to the AMASA project should and must be included and used to enhance the final product of the workshop.

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