

# **NSTF Workshop on Mathematics, Science, Technology and Engineering (MSTE) Education**

**Held on 1 March 2007, at the CSIR Convention Centre, Pretoria**

## **Report**

The workshop focused on **Mathematics, Science and Technology subjects**, as taught at **school level, by specialist teachers**. Thus the discussions were focused on **high school education, and particularly the FET band**. (Further meetings could be arranged in future to address the other burning issues in education). The workshop's purpose was primarily for NSTF members to raise their concerns and suggestions, as well as to discuss what role the NSTF can play on an ongoing basis in this regard. The emphasis was on participation and interaction, and reaching constructive conclusions and decisions about meaningful ways forward. One of the intended outcomes is to **feed back constructive comments to the DoE, DST, and the National Ministries of Education, and Science and Technology** - particularly from NSTF's professionals (engineers, researchers, etc)

The MSTE Education Task Team was formed to take forward serious suggestions from this workshop, and so ensure that this is not a once-off meeting of concerned individuals, but an ongoing initiative to coordinate and share our efforts, and to communicate meaningfully with Government.

The workshop programme consisted of the following items:

- Background information on the Trends in International Mathematics and Science Study (TIMSS) results (See the PP presentation by Vijay Reddy of the HSRC, presented on her behalf by Jansie)
- Introduction of the workshop's concerns (by Jansie)
- Group discussions on Current National Education Initiatives, particularly the FET Curriculum and the Dinaledi schools programme (everyone) See summaries of the conclusions of the two groups below.
- DST's Youth into Science Strategy (Lebs Mphahlele, DST). See PP presentation.
- Presentation of 'Academy' of Educators concept (Jansie): the establishment, by the existing Associations of educators, of a specialised 'Society' or 'Academy' of MSTE Educators, for the purpose of honouring those educators whose work is exemplary and inspiring. See PP presentation.

Participants were asked to bear in mind the following questions for consideration throughout our various discussions:

- How can we best collect our concerns, opinions and suggestions, and make them known to Government, including Provincial Education Departments?
- How can we stay abreast of developments in MSTE Education policy and practice?
- What can the NSTF do to contribute to the improvement of MSTE Education? (As a body of diverse SET stakeholder organisations, what is appropriate for us to do?)

- Is there anything we can do about the ongoing challenges of **Educators** (issues of training, support and retention) and **Resources** (text books, laboratories, computers, etc.).
- How can we best promote professionalism in MSTE Education?

### **Introduction:**

1. Briefly about the role of the NSTF, its main challenges, and its membership.
2. The NSTF and Education:

### **Education and training remain burning issues on the NSTF's agenda.**

#### **Particularly:**

- Education at school level: Mathematics, Natural Sciences, Technology, Information Technology etc. (MSTE Educ);
  - Also at school level: career guidance (SET careers)
  - Education/training at FET level: in technical and technological fields (as well as MSTE and career guidance)
3. At tertiary level, the NSTF's particular concerns are the following:
    - Mathematics, Natural Sciences, Technology, Information Technology, and related studies, & all branches of engineering
    - Both Universities and Universities of Technology
    - Post-graduates studies in SET fields
    - Research in SET fields
  4. Concern has been expressed over a number of years about the following related issues:
    - Shortage of MSTE educators, lack of requisite skills and experience, and suitable mentors
    - Attitude and morale among educators
    - Need for greater awareness among educators and the community, of MSTE skills, engineering, and the impact on skills base and competitiveness of SA
    - Unemployed SET graduates
    - Research skills
  5. Existing NSTF initiatives:
 

At the annual NSTF Awards:

    - Recognising best girl learner/s in Maths & Science
    - Recognising girl learners in Olympiads/Expo's
    - Recognising best M & S educators
    - Recognising Dinaledi schools
    - Award for research capacity building (post-grad)
  6. Suggested NSTF initiatives:
    1. NSTF Awards: recognition of educator trainers
    2. Establishing "Academy" of MSTE Educators
    3. Facilitating placement of SET Graduates

4. Encouraging SET Graduates to go into teaching, or assist in classrooms,
  5. Raising awareness among school educators about SET careers
  6. Exposing teachers to industry
7. It is suggested that the following be regarded as SET related school subjects:
1. Agricultural science
  2. Agricultural technology
  3. Civil technology
  4. Computer Applications Technology
  5. Electrical technology
  6. Engineering Graphics and Design
  7. Geography
  8. Information Technology
  9. Life Sciences
  10. Mathematical Literacy
  11. Mathematics
  12. Mechanical Technology
  13. Physical Science
8. Expected outcomes of this workshop:
- Report of feedback from this workshop, to be forwarded to DoE, DST, and circulated to NSTF membership;
  - At least one Task Team to take resolutions concerning NSTF involvement forward;
  - Series of workshops/seminars focusing on MSTE Education;
  - Taking back to our organisations Proposals to 'adopt' individual Dinaledi Schools.
  - Taking back Proposals to offer prizes to the top 3 Dinaledi Schools at the NSTF Awards.

### **TIMSS Results Presentation:**

TIMSS 2003 was conducted at the grade 4 and 8 level – South Africa participated at the grade 8 level. 50 countries participated. Data was collected at the end of 2002 –of about 9000 learners.

South Africa's results were far below average, but the range of scores was greater than for other participating countries, indicating the inequalities still very evident in the quality of our education. The mean of the ex-House-of-Assembly ("white") schools is almost equal to the international mean, whereas the national SA mean is far below that.

A comparison of the Human Development Index of the 9 provinces with their respective performance in TIMSS, suggests a correlation but the exceptions are thought provoking, e.g. the Northern Cape scored well in Mathematics, relative to its low Human Development Index.

The TIMSS report is available from the HSRC, and some copies were distributed at the workshop.

## Academy of MSTE Educators Presentation

*Dr James Hlongwane*, previous CEO of the NSTF, advocated addressing the following identified problems in schools:

- o “Too few MST educators,
- o lack of capacity among MST educators,
- o lack of incentives to encourage people into the profession and retain them,
- o lack of motivation for MST educators.
- o Teachers’ qualifications, practices and their motivation impact on the quality of curriculum delivery.”

The proposal is that:

MSTE educators be given a special position, a special body be established to honour them and promote professionalism among them...and that an “Academy” be formed to fulfill this purpose.

Such an Academy should be...

- An honourific professional body, such as for scientists. This concept is acceptable in relation to the sciences in various countries. ‘US National Academies’, e.g., is a partnership of the Academies of Science & Engineering, & the Institute of Medicine.
- Perhaps it is most appropriate for such an Academy of Educators to form part of the Academy of Sciences of South Africa (ASSAf)
- The Academy might in time become a Statutory body (or part of...).

Purpose and objectives would be:

- Recognizing, stimulating, nurturing, and strengthening professional excellence in the delivery of educational services in MSTE subjects, in further education institutions (high schools and FET Colleges).
- Providing expertise in the fields of MSTE Education, particularly for the benefit of sound decision making in Government.

Members of the Academy would be:

- excellent educators in MSTE,
- excellent researchers in MSTE education, and/or
- excellent trainers and mentors of MSTE educators.

The proposal needs further discussion and consultation.

## **FEEDBACK FROM DISCUSSION GROUP (1) AT MSTE EDUCATION WORKSHOP**

### **New Curriculum:**

- There is a concern that industry has little influence on curriculum content design.
- FET subject list currently missing (Industrial) Design. Support quick introduction of the subject.
- SET graduates not finding employment easily. The curriculum should provide a better basic preparatory education. Eg. IT literacy, admin skills etc.
- Assessment is problematic as the same people are setting tests and the (outdated) philosophy remains.
- Maths and science achievement depend on delivery of the whole curriculum,
- Teachers are unhappy about the new science curriculum and what they have taught. Learners have not mastered basic content enough. (The exemplar exam was of a high standard but learners found it very difficult.)

### **Dinaledi programme:**

- Possibly the intention is to restrict focus on the middle group of schools in order to lift' their performance before seeking to help all by distributing resources equally.
- How do non-Dinaledi schools get encouraged to improve?
- We cannot ignore those learners and schools who may not be at the top but who are improving. We need more incentives for improvement rather than just achievement at the top.

### **Educators:**

- Teachers lack knowledge and are not up to date. Industry has a role to play in keeping teachers abreast of developments in MST. Internships
- We need to reinstate an ongoing discourse between science and maths educators.
- The existing teacher internships need too much paperwork. Internships are also largely offered by privileged schools and then teachers return to their own schools, unprepared for the reality of their context.
- Lack of HR policy coordination, even between government departments. (There is growing recognition of the need for collaboration at higher levels but will take time before we see results.)
- Graduate teacher numbers are too low and cannot be allowed anymore.
- Teachers' content knowledge is vital. We need more understanding of what a good teacher should be able to do.

### **Quality of matric:**

- No correlation between matric marks and HE scores. (FSATIE). There must be seamlessness between school, HE and employment in terms of the quality of achievement and quality. Many school leavers are functionally illiterate despite achieving passes at matric.
- We need better numbers and quality of school leavers.

### **Unemployed Science graduates:**

- Graduates don't know how to look for jobs. We need ways to improve information and opportunities.
- We need better numbers and quality of university graduates.
- SET graduates not finding employment easily. The curriculum should provide a better basic preparatory education. Eg. IT literacy, admin skills etc.

## **FEEDBACK FROM DISCUSSION GROUP (2) AT MSTE EDUCATION WORKSHOP**

### **General:**

- Policy - Overlap between the Technical schools and FET colleges. How to recognize these students? Transition problems.
- Acknowledgement of corporates involved in MSTE Education.
- Start at primary school – right at the beginning of schooling.
- NSTF to assist with a long-term strategy to help the situation and not hurry and focus on immediate results. The focus is too much on short term results!
- Instead of removing some Dinaledi schools because of poor results, rather find interventions to improve schooling at those schools.
- Curricula are constantly changing and could contribute to the problem.
- Suggest to retrain the trainers. Educators discouraged because of workshops only focusing on policy. Change the focus of workshops to issues that would assist educators in the classroom.
- Cognitive problems – focus on perceptual learning.
- DoE do not facilitate workshops. Difficulty with implementation of DoE requests.
- In UK educators are relieved from duties to attend training and workshops.
- Focus on ways to convey knowledge to users – effectively
- Training centres are good but have we recognized the constraints, lack of resources that face educators?
- DoE to incentivise teachers to attend Saturday training sessions. Promote teaching in MSTE.

### **Dinaledi Schools**

- Concerned about the allocation of resources and prizes and awards to Dinaledi schools. Maths Learning material specially provided to a Dinaledi school was reviewed and found to be not up to standard. Need a greater focus on the development of material rather than rely on the educators that may or may not have the requisite skills.
- Dinaledi schools to take up more HG students.
- Dinaledi schools do not perform exceptionally well!
- More learners are taking up maths but are having problems coping!
- Maths literacy has closed the door for SET in HE. Catchment area becoming smaller!
- Feeder primary schools impact high schools.
- Clear guidelines to schools for the taking of Maths (re also Maths literacy).
- Dinaledi schools are here to stay. As specialists we should help DoE to make it a success. Look at the system, find out what works and what not and then roll-out a strategy that will work.

### **Adopting schools?**

- Good idea. Find out what this adoption means? Is it to visit schools and motivate them? Or is it more? It should be to the benefit of education in the school. Not only 'soft' assistance. And Not to sell your products.
- Develop teacher professionalism! It should be about the teacher wanting to develop his/her own career.
- Concerned that if we go with the adoption initiative, then we are saying that Dinaledi is working! DoE should rather consider MST schools where the learners were specially selected to go there.

- Look wider than adopting and look at servicing schools. Add value to teacher development by providing training for instance. Mentorship / role modelling. Adapt an outreach to schools in the provinces.
- Do not only focus on students going into universities. The shortages are bigger in the FET colleges. Point out other routes for students to go.
- Lack of capacity at district offices – add to problems in FET. Facilitators can't give guidance and teachers have to find their own way. Seems to be a provincial issue.