

SCIENCE OSCARS & MATRIC PASS RATES

QUALITY AND QUANTITY IN STEM EDUCATION

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CELEBRATING QUALITY

- NSTF 'SCIENCE OSCARS':
 - OUTSTANDING CONTRIBUTIONS TO SCIENCE ENGINEERING & TECHNOLOGY (SET) AND INNOVATION IN SOUTH AFRICA
- DST 'WHAT A GREAT IDEA':
 - AWESOME SOUTH AFRICAN INVENTIONS (BRUTON)
- Professional Societies: Numerous awards

STRIVING FOR QUANTITY → HUGE WASTAGE

SCHOOL SYSTEM:

- 30% of all Grade 2 students reach Grade 12

MATRIC PHYSICAL SCIENCES:

- Participation Rate = 30%
- Pass Rate (40% = PASS) = 35%

UNIVERSITY SYSTEM:

- 30% complete degree in prescribed time
 - 50% complete within 5 years
- (over all subjects and all contact universities)

TRYING TO REDUCE WASTAGE IN THE MST EDUCATION SYSTEM

- IMPROVING MATRIC PASS RATES:
 - In-service teacher training and support
 - Winter schools
 - Matric crash courses
 - Teacher compliance (Prescribed Practical Activities)

- IMPROVING PARTICIPATION RATES:
 - Science fairs & expos
 - Science centres
 - Achievement awards

THE LOW PARTICIPATION RATE IN PHYSICAL SCIENCES – WHY?

- Learners understand the importance of PS for careers in SET
- Learners see SET employment possibilities
- Learners know PS is hard (low pass rate)
- PS teachers do not inspire learners
- Learners choose Life Sciences (LS) instead
- PS teachers are often qualified to teach LS, but are persuaded by desperate school principals
- This is the science analogue of Maths vs Maths Literacy

PHYSICAL SCIENCES TEACHERS

- Good quality PS teachers are key to solving both the Pass and Participation Rate problems
- To be a good teacher you should love children and love the subject
- Loving the subject depends upon content knowledge and confidence in its application
- The knowledge must go beyond that defined by the curriculum statement
- The knowledge must include awareness of the Big Ideas of Science and the Big Ideas about Science
- To express both loves, the knowledge must include PCK – pedagogical content knowledge

ITE IN PHYSICAL SCIENCES

- Initial teacher education (ITE) is mainly via a BEd degree
- The BEd is a 4-year professional degree including teaching experience
- Entry requirements are lower than for other professional degrees such as BScEng, MBBCh or even BSc.
- New graduates specialising in PS have modest subject knowledge (even measured against the school curriculum)
- ‘Mediocrity has penetrated into higher education too’ (Jansen)
- Mediocre new teachers will not improve Pass and Participation rates

THE PHYSICAL SCIENCES CURRICULUM – WHO DOES IT SERVE?

- ‘a traditional and prescriptive, teacher-centred, content-based’ curriculum (UMALUSI)
- depressing in its neglect of recent topics that might inspire – electronics, materials science, fuel cells, SKA...
- distressing in the low quality of the CAPS document – misconceptions, no connections between knowledge areas, totally inadequate Guidelines for Teachers
- designed for a minority, instead of for all
- serves neither quality nor quantity objectives
- deserves serious debate as to what overarching goals it should have, as there is no alternative curriculum
- consider World trends towards science for all, as exemplified in the proposals of the National Academy of Sciences (USA) and the Association for Science Education (UK)

THE 'T' IN MST EDUCATION

- 'T' is for Technology Education – not ICT
- Only offered to all learners in Grades 4-6 (NS & T) and 7-9 (T separate from NS)
- Specialised technology education (eg Electrical Technology) offered to a very small minority in the FET band
- FET technology subjects used to require PS, but now TS (Technical Sciences)
- TS is very largely PS, with selected bits changed – still only offered to those doing technology subjects
- A re-conceptualised TS could also serve many who do not want to do technology subjects

QUALITY & QUANTITY IN STEM EDUCATION

- Both quality and quantity are national needs
- National resources are very limited
- Prioritisation is therefore essential (DBE MTT on MST)
- ‘Teachers cannot effectively teach what they do not know themselves’ (McKinsey & co, 2007)
- ‘No education system can out-perform the quality of its teachers’ (Ogunniyi & Rollnick, 2015)
- ‘Weak teacher knowledge creates a low ceiling which South Africa cannot circumvent’ (RESEP, 2016)
- The message is clear: all other problems are secondary to the problem of **teacher** quality and quantity

MORE & BETTER MST TEACHERS

- ITE – whatever it takes, we must do better – increased funds and staffing for university BEd courses in MST education; attractive student bursaries in return for commitment
- INSET – university-based short courses and qualifications such as ADE in MST education; provide special courses for subject advisers
- INSET – ban spending on ill-prepared, brief interventions
- Develop meaningful teacher guides (print and electronic)
- ProSET should discuss how they can help ‘lift the low ceiling’
- NSTF should consider Oscars for MST educators.

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