
Teachers and teacher quality: A critical issue in school mathematics and science

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ASSA Forum
1 October 2009
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Some questions

- What Initial teacher education and professional development programmes are currently available, and what can we say about their quality and effectiveness?
 - How can good quality maths and science teachers be recruited, prepared and retained?
 - What interventions are needed to increase the effectiveness of existing mathematics and science teachers?
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But first ...

- The quality of an education system cannot exceed the quality of its teachers

And

- The only way to improve outcomes is to improve instruction

(McKinsey report , 2007, p8)

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- Quality teachers are teachers who:
 - have a deep understanding of and passion for the knowledge and practices underpinning their specialisation
 - know how to transform this into quality learning opportunities for children in their care
 - are committed to the profession, children in their care, the school community and uplifting society more generally
 - continuously learn in-and-from practice
 - Identity: consciousness and conscience
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To improve quality we must consider:

- the supply of future mathematics and science teachers – how we attract them, prepare them, induct them into the world of work and retain them, and
 - the existing cohort of mathematics and science teachers – how we can support them to take responsibility for their professional development and to become confident and competent to teach the NCS
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- And make sure that programmes to do this are more effectively regulated
 - HEIs need to be more accountable, responsive and responsible
 - PEDs need to be more responsible re upgrading
 - E.g. Some current problematic practices: NPDE and ACE programmes
 - Struggle for resources ... Practice teaching
 - Selections of teachers into formal programmes
 - Managing research, teaching and curriculum development
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Current formal teacher education programmes in South Africa

- Initial preparation
 - Bachelor of Education (B Ed)
 - General Degree + Post Graduate Certificate in Education (PGCE)
 - 'Upgrading' programmes (in-service)
 - National Professional Diploma in Education (NPDE)
 - Advanced Certificate in Education (retraining/ upgrading) (ACE)
 - Advanced learning
 - Advanced Certificate in Education (extended roles) (ACE)
 - Bachelor of Education (Hons) (B Ed (Hons))
 - Masters in Education (M Ed)
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Some comments on current practices: initial teacher education

- Differentiated curricula and understanding of what should be in the ITE and how it should be made available to teachers
 - Lack of effective regulation to ensure responsive curricula
 - Funding problems
 - Problem with practice (learning in and from practice)
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And continuing professional development

	Math Lit	Math/ MST	Science Ed/ Physical Sc	Life Sciences
registrations	876	3542	389	201
programmes	9	30	10	5
Total registrations in ACE programmes				43803

No of Registrations on ACE programmes in mathematics and science across 22 HEIs offering teacher education and development programmes 2008
(survey of HEIs 2008; not HEMIS verified)

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- What and how become crucial
 - Education and teacher education are social institutions that pose moral, ethical, social, philosophical and ideological questions. Although questions of value and ideology underlie many of the most contentious disagreements about teacher education, these arguments are often mistakenly treated as if they were *value-neutral and ideology free*

(Cochran-Smith and Zeichner 2005, pp. 2-3, emphasis added)

The question of knowledge

- Debates around the ‘what and how’ of (mathematics/ science) teacher education programmes:
 - selections into the curriculum – what should be privileged and why?
 - who should teach teachers – mathematicians/scientists? mathematics/ science education specialists? expert teachers?
 - how should teachers be taught?
 - where and when?
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- 'Content' knowledge is the most important aspect
 - What counts as 'good' content knowledge for mathematics teachers and mathematics teaching?
 - mathematics from an academic disciplinary perspective?
 - mathematics **for** teaching?
 - mathematics relevant to the NCS?
 - selections from mathematics education?
 - on what grounds are choices made
 - empirical/ theoretical/ ideological/ political?
 - does context change what counts?
 - e.g. should the same content be selected for a rural/ urban context; a foundation / intermediate phase or senior/FET phase programme?)
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- Professional knowledge, professional practice and developing professional judgement are essential aspects of teacher education
 - What counts as knowledge for learning ‘good’ practice?
 - Knowledge-from-practice
 - knowledge-in-practice
 - What does it mean to develop as a professional?

 - What does it mean to call for a focus on ‘more’ content?
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Math Teacher roles – in relation to mathematics

Engaging with and evaluating learner productions (in practice)

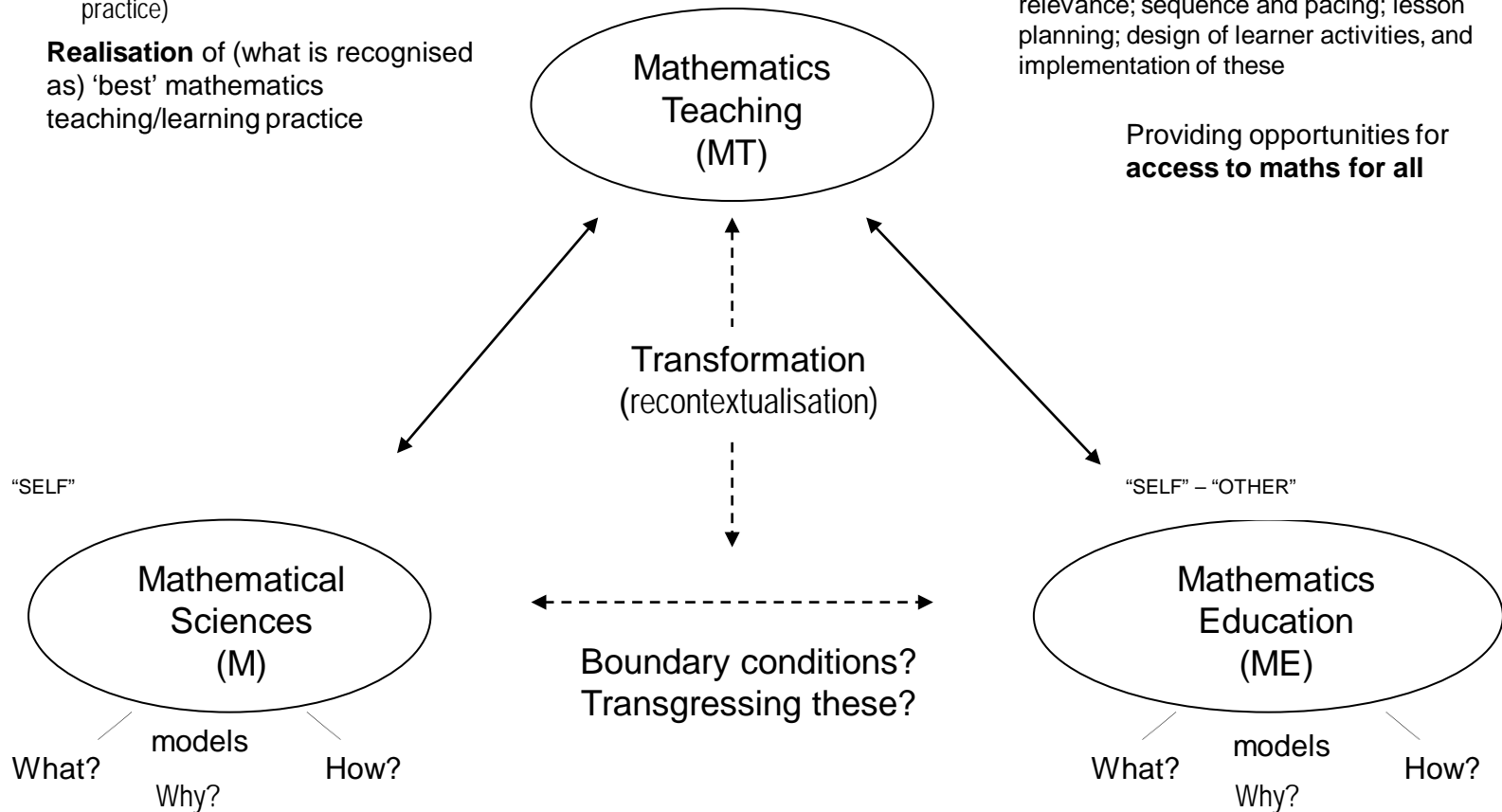
Realisation of (what is recognised as) ‘best’ mathematics teaching/learning practice

Managing learning and creating learning environments for mediating conceptual-knowledge-in-practice

“CLASS” – “OTHER”

School curriculum: interpreting and unpacking the FET school mathematics curriculum –in-practice; making connections (productive inter- and intra- discursive integration); questions of relevance; sequence and pacing; lesson planning; design of learner activities, and implementation of these

Providing opportunities for **access to maths for all**



A model: specialist discourses in mathematics teacher education

National strategic objective

- More teachers, better teachers (NPFTED)
 - Initial teacher education (IPET)
 - Funza Lushaka Bursaries
 - Increased numbers in initial TE programmes (focused on national priority areas)
 - Teacher recruitment campaign
 - Continuing professional development (CPD)
 - CPTD system development
 - CPD programmes
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Funza Lushaka and recruitment campaign

- Lever up the system
 - Improved quality of entrants
 - Greater interest and applications for ITE
 - Increased enrolment in ITE
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Distribution of 2009 Funza Lushaka bursars across different programmes (total 9294)

B.Ed 1st year	B.Ed 2nd year	B.Ed 3rd year	B.Ed 4th year	PGCE	Other B degrees
30%	24.6%	21.2%	15.3%	6.6%	2.3%
91%				7%	2%

Distribution of bursaries across differed phases

FP		FP/IP		IP		IP/SP		SP		SP/FET		FET	
PGCE	B.Ed	PGCE	B.Ed	PGCE	B.Ed	PGCE	B.Ed	PGCE	B.Ed	PGCE	B.Ed	PGCE	B.Ed
0.4	16.6	0	0.1	0.4	8.6	0.4	9.7	0.5	6.9	2	16.4	3.2	34.7
17%		0.1%		9%		10.1%		7.4%		18.4%		37.9%	
100%													

- Why? Does it matter? Do we need to shift?
- Importance of using resources of whole system and ensuring access to powerful knowledge and practices

IP and SP student teachers supported in TE programmes through FL (2009)

IP Mathematics	520
IP Nat Science	473
IP English language	424
IP African Language	327
IP Technology	279
SP Maths	508
SP English Language	403
SP Nat Science	383
SP Technology	311
SP African Language	289

FET student teachers supported in TE programmes through FL (2009)

Mathematics	1147
English Language	814
Physical Sciences	609
Life Sciences	601
African Language	569
Comp App Tech	416
Mathematical Literacy	142
Agricultural Sciences	120
Information Technology	99
Eng Graphics & Design	86
Civil Technology	34
Electrical Technology	32
Mechanical Technology	16
Agricultural Technology	15

What is needed now?

- Need to increase support (greater range of specialisations; double numbers - move from 20% to 40%)
 - Focus on quality of programmes and support for improved relevance, level and access to all forms of knowledge (research and develop curricula and materials – e.g. EC project)
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CPD

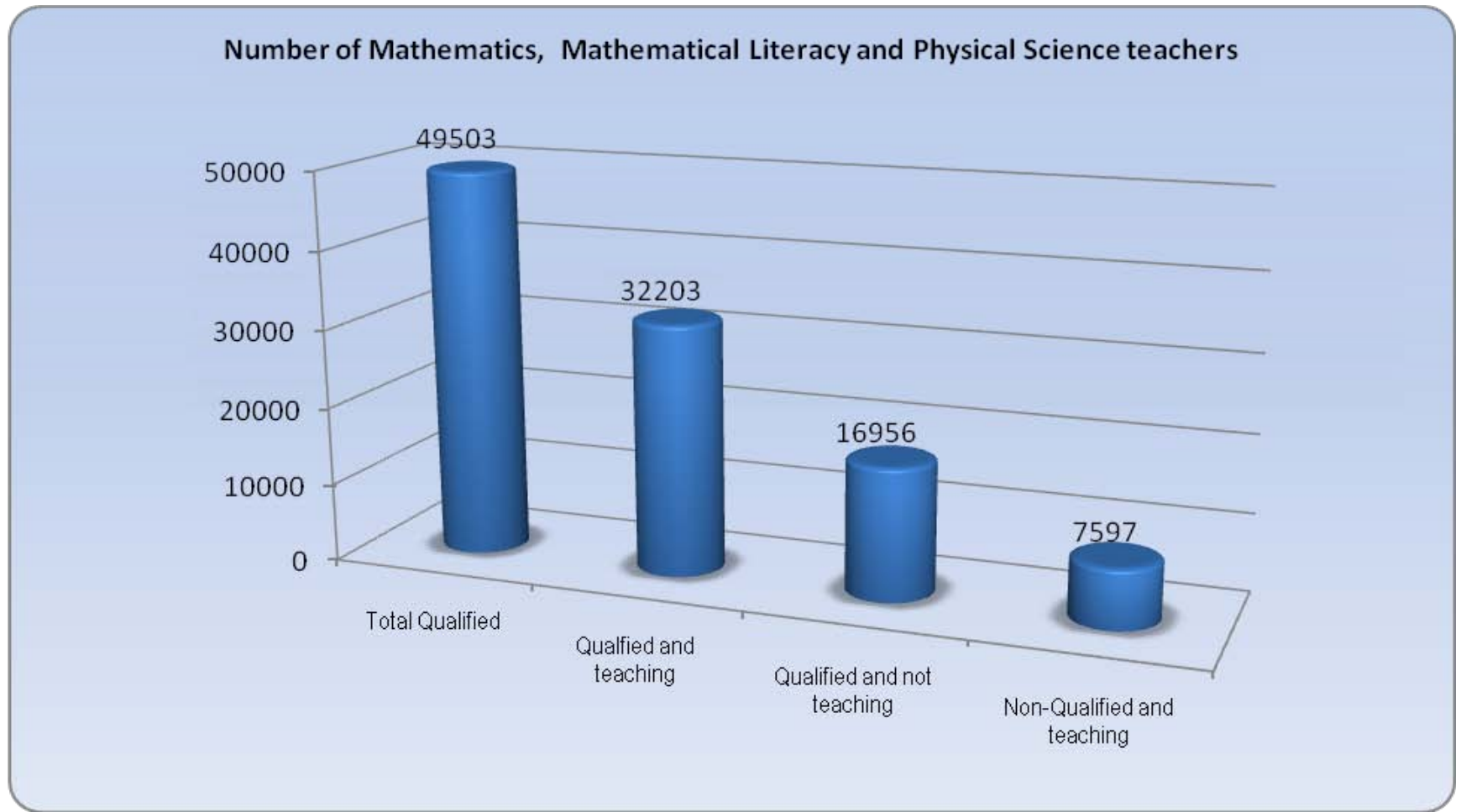
- Change from 'upgrading' mentality
 - Career path development
 - Support for teachers to become more confident and competent in what they teach
 - Encourage teachers to take responsibility for own professional development and reward them for doing so (SACE CPTD system)
 - Encourage teacher learning communities and to study own practice
 - But need to know
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- We need to know ...
 - Who are our mathematics teachers?
 - What is their qualification profile?
 - What are their competences with respect to teaching FET mathematics (wrt NCS)
 - How can we support different needs in the system
 - Qualification programmes? Which ones?
 - Short CPD courses?
 - A proposed national project for developing competence to teach Mathematics (at all levels)
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Who are our Mathematics teachers?

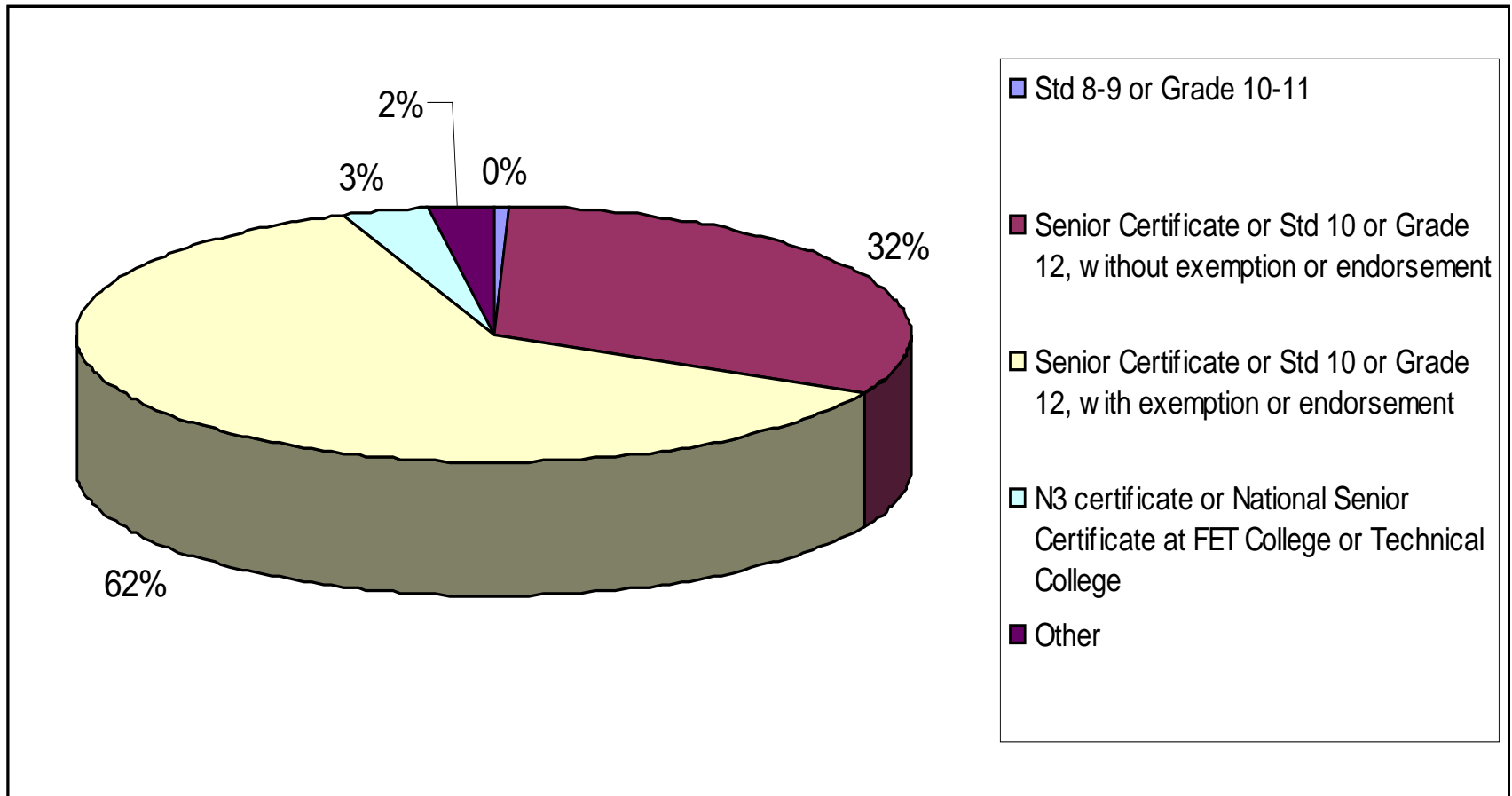
- Data not good enough
- National survey (2008)
 - maths, maths lit, physical science
 - 6991 schools surveyed; 5420 returns, i.e. 78% return rate; total no of secondary schools +/- 8000)
- Teacher qualification Survey (2009)
 - Statistically significant sample of 600 schools (all types and phases, across all provinces, census style)
 - 226 FET mathematics teachers in sample
 - Limited ...but informative
- WCED research on supply and demand

Total number of qualified and non-qualified teachers for Mathematics, Mathematical Literacy and Physical Science



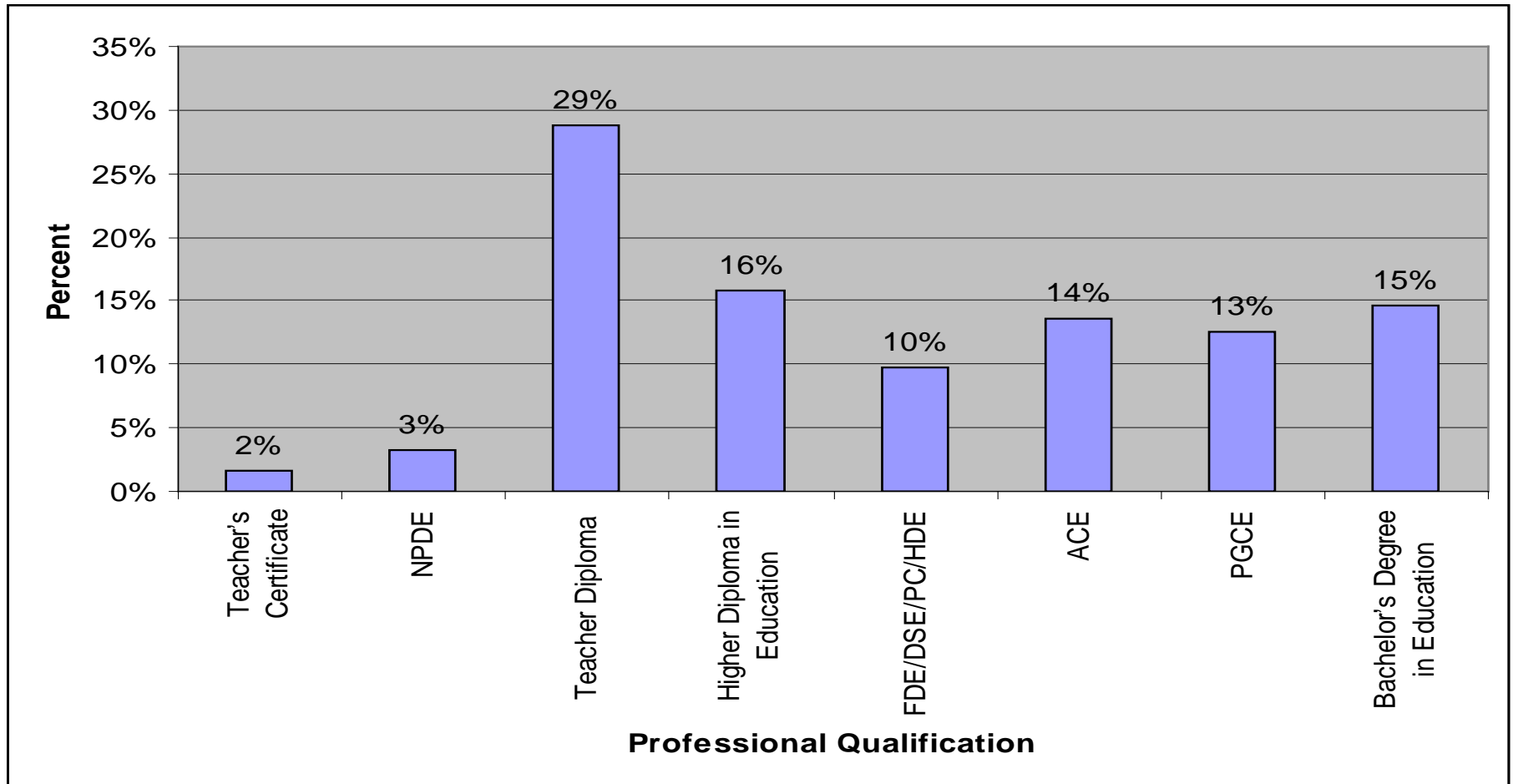
Source: Mathematics and Physical Science Survey, 2008

Proportion of FET Phase Mathematics Teachers by Highest Secondary School qualification (n = 226)



Source: Teacher Qualification Survey (2009)

FET Mathematics teachers: highest professional teaching qualification

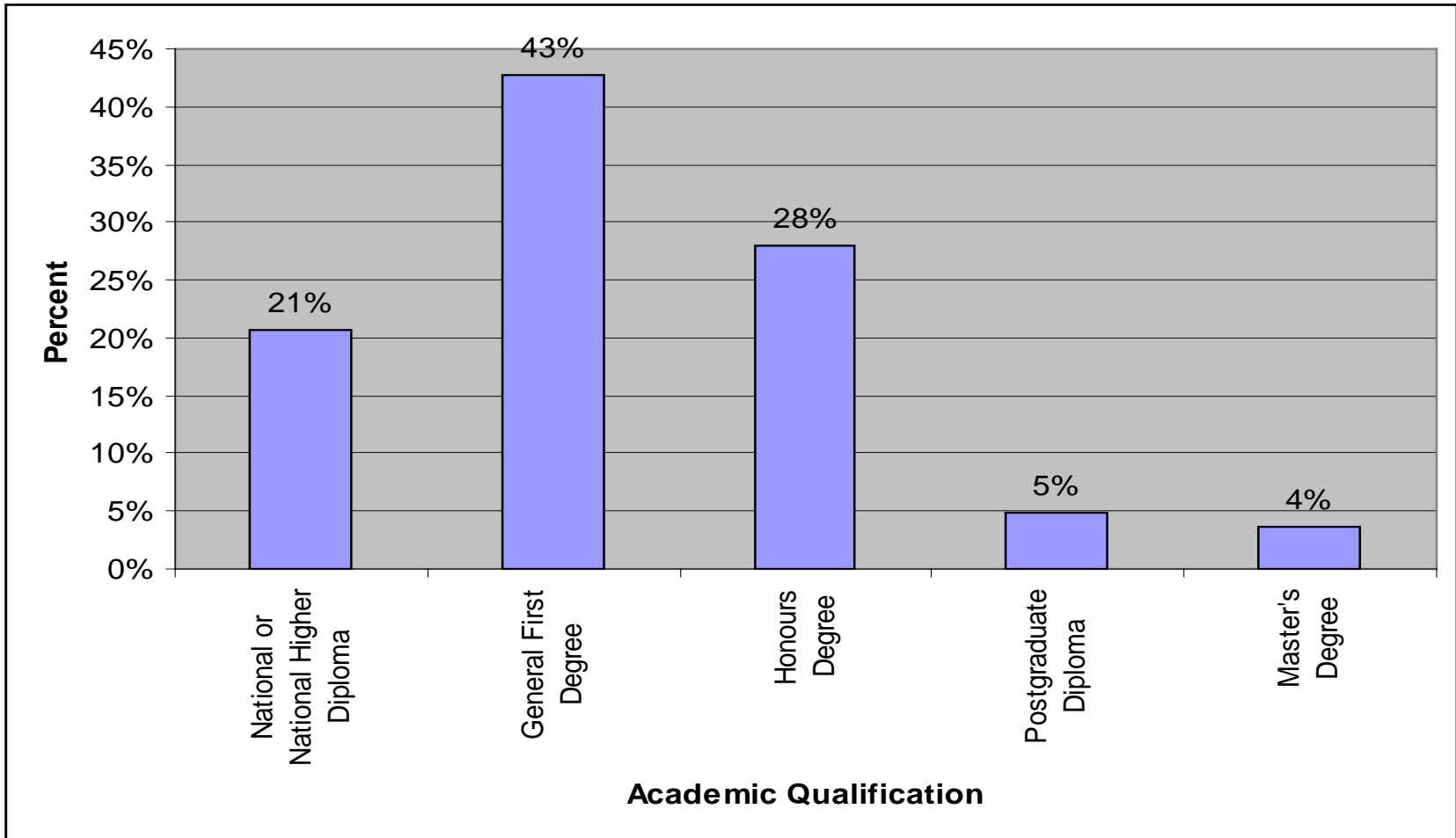


As a percentage of those in possession of a Professional Teaching qualification (n = 184) Source: Teacher Qualification Survey (2009)

Specialisation in professional qualification

- 81% have a professional qualification
 - Of these:
 - 67 % have specialized in Mathematical Literacy (123)
 - 61 % in Mathematics (113)
 - 29 % in Life Sciences (54)
 - 27 % in Physical Science (51)
 - 19 % in English (35)
 - From 0 to 6 % in a variety of other subjects
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FET Phase Mathematics teachers: highest academic qualification



As a percent of those in possession of an Academic Degree or Diploma (n = 82); Source: Teacher Qualification Survey (2009)

Specialisation in academic qualification

- 36% have academic qualifications
- Of these:
 - 57% have mathematics subjects (47)
 - 63% Have mathematical literacy subjects (52)
 - 21% Physics and/or chemistry subjects (17)
 - 13% Life sciences subjects (11)
 - small %s in wide range of other subjects (51)

Some insights:

- ❑ Most have a professional teaching qualification in Maths literacy rather than Maths itself, e.g.
 - General mathematics
 - Mathematics didactics etc
 - ❑ Only 47 out of 226 have some university level maths (no information as to the level acquired)
 - ❑ CPD is essential, but from a Maths literacy base
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What CPD is required?

- A proposed national project for developing competence to teach Mathematics (at all levels)
 - Not focused on upgrading qualifications
 - Although do need to develop formal programmes for career dev (master teachers, teaching and learning specialists)
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Project Aim

- to deliver quality continuing professional development (CPD) programmes for practicing teachers focused on developing knowledge for teaching the National Curriculum
 - move away from ‘shopping lists’ and ‘information’ workshops to pedagogically deep and *evaluated* learning opportunities
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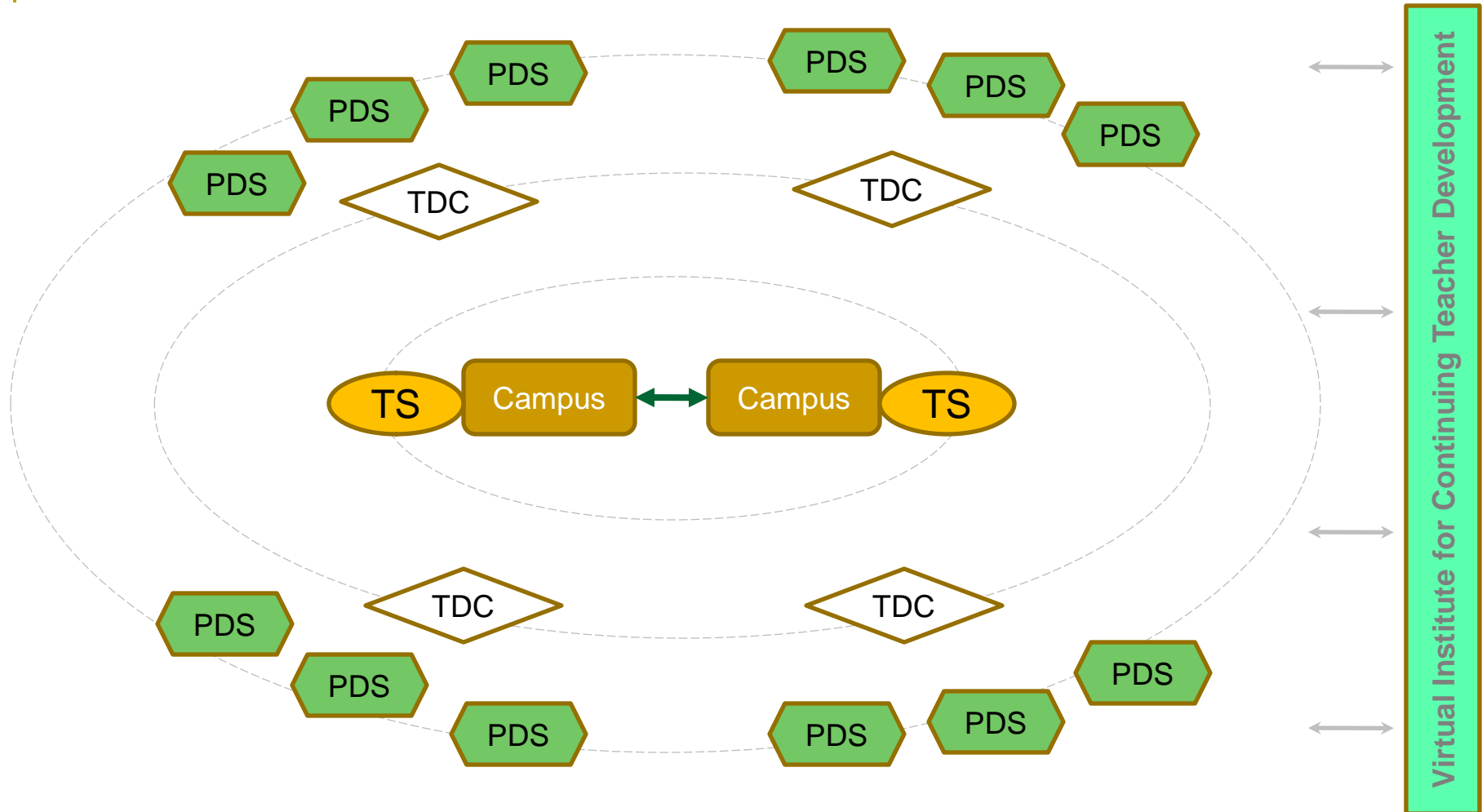
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- Teachers need to identify what they need to know in order to teach the curriculum competently
 - A system to enable teachers to assess themselves against *standards of curriculum competence*, and
 - on the basis of *self assessment* and realisation of an area of ignorance, take CPD course that would be *targeted at dealing with that specific area of need* (and evaluated for endorsement through the SACE CPTD points system)
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Responding to contextual realities

■ Access

- to formal qualifications
 - High quality Initial teacher education opportunities for students from rural and poor contexts
 - Formal CPD opportunities for career development close to where teachers practice
- to short pedagogically deep CPD programmes focused on teachers' needs
 - Currently mostly
 - curriculum 'information sharing'
 - 'shopping lists'
 - Challenge of needs development identification of practicing teachers – focused on curriculum competence
- to formal programmes for career development

A NATIONAL SYSTEM FOR TEACHER EDUCATION AND DEVELOPMENT



Project Activities: 2010/11 – 2012/13

- Unpack the NCS curriculum contents in order to define what it means to have **curriculum competence to teach** (conceptual knowledge and pedagogic content knowledge ...).
 - Identify key **conceptual areas and knowledge for teaching** that underpin this analysis of curriculum competence
 - Produce a **set of standards for teacher curriculum competence** for mathematics teaching (all phases; FP numeracy; IP, SP and FET Mathematics; FET Mathematical Literacy)
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- **Develop diagnostic assessments**
 - Design diagnostic assessment sets to cover the key conceptual areas and curriculum competence standards;
 - on-line and paper-based diagnostic assessments available to teachers

 - **Develop CPD courses and materials underpinning each conceptual area/ assessment set**
 - Identify existing materials based courses in practice
 - Adapt/ develop text materials, video models and ICT modules , that are pedagogically sound, evaluated and can be delivered flexibly to teachers in remote areas
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Processes and involvement

- Virtual centre(s) for CPD established through the process
- HEIs and others who have *expertise* brought together
 - communities of practice to develop capability across the system (e.g. mathematicians *and* mathematics education academics)
- Courses to feed back into formal programme design
- In the long run curriculum competence standards developed are incorporated into the standards for formal initial and continuing TE programmes (to ensure relevance and accountability) for all phases/ learning areas/ subjects

Invitation to express interest

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