Teacher education through distance education – Rising to the challenge

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Abstract

This paper explores the current and future potential of the use of distance education methods for teacher development drawing upon many years of engagement with Ministries of Education and Higher Education Institutions involved with teacher development in south, southern and central Africa. The paper argues that it is appropriate and desirable for distance education methods to be used in teacher development programmes but argues that many current practices need to be questioned in light of postmodern perspectives and an increasingly globalised society. The use of distance education for teacher development should not be dictated by economic arguments alone but also, or perhaps rather, informed by concerns about the nature and quality of the education and training provided and how this manifests itself in improved quality of learning in classrooms.

Key Words: distance education, teacher development, Africa

Introduction

In general, Africa is struggling to give effect to the Education for All (EFA) mandate and to achieve the educational Millennium Development Goals (MDGs). The 2005 EFA Global Monitoring Report emphasises the centrality of teacher development to this endeavour. Not surprisingly, the African Union has prioritised teacher education in its Second Decade of Education.

The Nepad education desk (NEPAD c.2006:2) has identified the following challenges facing many Ministries of Education in Africa with respect to teacher education:

- Inadequate training facilities and funding for initial (pre-service) training;
- Inadequate or poor continuous (in-service) teacher development and teacher training facilities;
- Shortage of trained and qualified teachers;
- Lack of opportunities for continuous professional development;
- Disrupted teaching profession due to current or prior internal conflicts or wars;

- Shortage of reference and training materials for teachers;
- Underdevelopment and under-utilisation of Information Communication Technologies (ICTs) to benefit teacher training and development and
- Depletion of teachers due to HIV/AIDS and the decline in the number of people entering the teaching profession.

Moon (2006:iii-iv) in summarising research into policies and programmes for teacher education observes that acute shortages of teachers exist; large numbers of para-professionals and community volunteers have taken the place of teachers; the status of teachers is in sharp decline and across sub-Saharan Africa rural communities are the most challenged in recruiting and retaining qualified teachers. He reports that in some countries in sub-Saharan Africa, the shortage of teachers is formally acknowledged as a national crisis.

Well functioning teacher education systems are clearly central to the development of Africa. Now is an appropriate time to reflect on the contribution that distance education does and could make to teacher education.

This paper explores this issue with respect to five key questions:

- What is the role of distance education in the context of teacher education?
- Why use distance education for teacher development?
- Does distance education deliver?
- What are the challenges for improving teaching practices?
- What is needed for effective teacher education through distance education looking to the future?

What is the role of distance education in the context of teacher education?

Extensive and increasing use is made of distance education for teacher development globally (Robinson & Latchem 2003) and in Africa in particular in pursuit of EFA goals and a global shortage of teachers in general and primary level teachers in particular (ADEA 2002, 2004; Mattson 2004; Sayed 2006). Distance education is used in the

- initial professional education of teachers (IPET)
- the continuing professional development of teachers (CPET)
- IPET for teachers already in service
- development of education management.

In South Africa, in teacher education, distance education has long since played a far greater role – at least in respect of numbers enrolled and graduating – than face-to-face education. This phenomenon may well be repeated in other African countries like Kenya, Nigeria and Malawi which have seen large scale development of distance teacher education provision. Distance education may well be moving to centre-stage in teacher education. We need to understand why.

Why use distance education for teacher development?

In responding to this question, we need to have a common understanding of what it is we mean by distance education. In the context of teacher education and particularly given the range of knowledge, skills and values outcomes associated with teacher education, we have found it useful to understand distance education not as **a** mode of delivery with one identity, but rather as a collection of methods, deployed in various combinations to support identified educational outcomes:

> Distance Education needs to be conceived as a sophisticated collection of methods for the provision of structured learning in situations, increasingly the norm, where students are unable primarily to attend fixed classes at a centralised venue and in the physical presence of a teacher. (SAIDE, 2003)

It is increasingly clear that the conventional system of full-time, contact-based Colleges of Education and Education Departments in Universities is unable to meet the growing need for teacher development. Some of the reasons for this include that the numbers required exceed the physical capacity of institutions to accommodate them; that such institutions tend **not** to be situated in the rural areas where the need is often greatest; that curricula often do not speak to practice and, increasingly, that potential and current teachers need to be able to continue to work while they learn, especially in a context in which more of the cost burden for higher education has shifted to student fees in light of declining real state subsidies. Distance education methods, which facilitate learning that does not require students and teachers to necessarily be in the same place at the same time and can support the expansion of school-based teacher education programmes, are seen as a logical solution to this challenge.

However of great concern in many distance education endeavours is the tendency to add distance education responsibilities to the workloads of full-time academic staff in traditional contact-based institutions without relieving them of any of their responsibilities to existing full-time students or to the achievement of research outputs. This is usually a false economy and short-sighted as the inevitable result is poor quality work and staff burn-out.

Often a key motivation for the use of distance education methods is **purely** economic: a desire to make more efficient use of existing facilities coupled with an inability to replicate or expand these facilities. Research into the costs of educational delivery suggests that teacher education ***can*** be one of the more cost-effective uses of distance education able to achieve reasonable student success rates at unit costs that may be lower than in the conventional system. (Perraton 2000; Oliveira & Orivel 2003; ADEA 2005) This is due in part to the often large and recurring numbers of teachers involved which can lead to economies of scale; and a consideration of the opportunity costs involved in not removing practising teachers from their classrooms and therefore not having to employ an additional cadre of temporary replacements.

However programmes need to be costed very carefully to ensure the necessary recurring investment in quality programmes, materials, assessment and decentralised support to ensure cost efficient and cost-effective delivery. Sadly there is little evidence of this happening with Creed (2001:15) asserting that good

evaluations of the cost-effectiveness of distance education are hard to find, tending to be 'strong on description but weak on evaluative data, both quantitative and qualitative, on which to make judgements about effectiveness, costs and impact'. Furthermore there is a tendency to try to go to scale too quickly to meet urgent political (or funder) imperatives using models that are not ultimately sustainable (Mattson 2004; ADEA 2005; Mays 2005; SAIDE 2006). Of particular concern is the tendency to omit, or cut back on, any activities that relate to the formative assessment and decentralised support of students.

It should be noted that distance education provision is especially difficult and costly in the rural areas where the need is greatest and requires problem-solving in particular contexts. Models need to be developed and tested and guidelines provided both for replication and for innovation.

Craig and Perraton (2003:91-111) note that distance education has been used extensively for the continuing professional development of teachers in particular and seems to have the following advantages (which would presumably also be true for the initial training of unqualified teachers/para-professionals while in-service):

- An ability to reach teachers, who are often isolated, and provide them with professional development without taking them away from their home or workplace
- Providing teachers with learning and teaching resources
- Providing a programme in which learning can immediately be integrated with day-to-day teaching
- The possibility of achieving economies of scale.

Even traditional contact-based institutions involved in teacher education need to engage with distance education issues, such as materials and learner support, for extended teaching practice and so interest in the use of distance education methods in teacher education has grown. This is part of a general trend towards more open practices in education provision in which distance education methods are seen to provide more flexibility in learning options, especially in light of growing access to increasingly more sophisticated and increasingly less costly information and communication technologies.

The discourse has therefore seen a move away from simplistic economic arguments based on increasingly discredited solely paper-based correspondence models towards a more quality oriented discourse that explores the various merits of a blend of different methods and strategies (Dladla and Moon 2002; SAUVCA 2003; Sharma 2005; Welch and Reed 2005).

However, economic and political considerations have nevertheless seen an expansion in the employment of less well trained or untrained para-professionals and limited or no follow-up support for these underprepared practitioners (Mattson 2004; Moon 2006; GCE 2006). It is suggested that distance education methods, coupled with a reconceptualised curriculum, could help to address what some countries have begun to identify as a "crisis" in teacher supply and development.

Does distance education deliver?

Research suggests that distance education programmes have shown a positive impact on teachers' general and subject specific knowledge gains but that effecting improvements in classroom practice may require additional strategies.

Robinson (2003:195-6) notes the "limited evaluation data available" but suggests that "the following broad conclusions can be drawn (some more tentatively than others).

- Distance education programmes for teachers can provide acceptable courses and qualifications on a larger scale than conventional programmes and over a wider geographical area in countries with very differing infrastructures and for a wide range of purposes and learner levels.
- Successful completion rates for award-bearing programmes vary between 50-90 per cent. Examination pass rates tend, on the whole, to be similar to those in conventional programmes (though completion rates tend to be lower) ...
- In general, distance education programmes have demonstrated that they are effective in teaching academic subjects, though some subjects, such as science, mathematics or music, need greater elements of face-to-face teaching, interaction with tutors, coaching and practical work ...
- Teachers on distance education courses have achieved results equivalent to conventionally trained teachers, though with different profiles of strengths and weaknesses (Chale 1983; Mählck and Temu 1989; Nielsen and Tatto 1993) ... This points to a need ... for programme designs which take full account of subject and learner differences.
- Unqualified serving teachers on distance learning courses for initial qualifications are often rated more highly on classroom teaching than newly qualified college equivalents. However, two studies found that differences disappeared after a few years, with the exception of science teaching, where college-trained teachers continued to perform better (Mählck and Temu 1989, Chale 1993).
- Self-report data by teachers on distance education courses generally rate them useful and relevant to their teaching, especially where no other options are available to them, and commonly report increases in teachers' confidence, knowledge and teaching skills.
- There is relatively little evidence available on the transfer of teachers' learning to teachers' practice, as is also the case with more traditional training programmes.
- Where teachers in developing countries have low educational levels (such as incomplete secondary education) on entry to the distance education programme, they tend to achieve lower pass rates and require more learner support. This has implications for the cost and design of programmes.

In 2005 the DEOL Working Group of ADEA commissioned a comparative study of three distance education teacher development programmes in Mauritius, Tanzania

and South Africa. All three programmes were primarily print-based with support offered through occasional face-to-face contact and, to a much more limited extent, an array of information and communication technologies. While it is obviously not possible to extrapolate from three case studies to general practices in the region, the remarkable similarity in findings between the three case studies (which were compiled separately but followed the same mixed method research strategy involving surveys, document analysis, classroom observations and interviews) and Robinson's summary above supports the emerging argument that distance education has an important role to play in teacher development but that certain aspects require special attention. The study concluded, among other things, that:

> Teachers tend to overestimate the impact the course has had on their overall professional practice but there tends to be improvement in subject knowledge and in the self-confidence of teachers who complete their programmes.
>
> Teachers struggle to carry theory over into practice in their classrooms and in addressing real classroom problems, although this seems to be more of a problem in Mauritius and South Africa than in Tanzania. (Jeeroburkhan, Muganda, Mays, Posthuma and Holomisa 2006:5)

To sharpen the discussion on how distance education can deliver on its promises, it is useful to remind ourselves of the central purpose of teacher education: ***more, sometimes dramatically more and better teachers able to demonstrate improved classroom practice to ensure that learners learn effectively.***

This may seem obvious, but, given the desultory way in which teaching practice is often organised and assessed and the few credits it sometimes attracts, it would appear that the purpose of many teacher education programmes is to graduate rather than to become a competent or more competent teacher. As Robinson (2003:208) notes: "…*one issue affects conventional and distance teacher education programmes alike. The quality of teachers is mostly judged by the qualifications they have. Yet some of these bear little relation to the quality of teaching or to the use of training programmes to engender better teaching.*"

Teacher education involves a complex integration of at least three components (Lewin 2004: 7-11)

- Subject content knowledge – the knowledge and understanding of the school subjects or learning areas to be taught (or WHAT to teach)
- Pedagogic content knowledge and skills – the knowledge and skills to teach subjects effectively including creating the conditions under which learning can take place (or HOW to teach – in pre-service programmes this usually includes the teaching practice)
- Education or professional studies – understanding how children learn, locating the school in society, awareness of educational history and legislation, and the acquisition of professional identity (including addressing questions about WHY we teach).

Increasing emphasis is being placed on pedagogic content knowledge and skills. This is the area where distance education has often ***not*** demonstrated success. In

fact, developing the practice of teaching has been labelled by some as distance education's Achilles' heel. This seems a rather harsh judgement, however, when one considers that where research into classroom practice has taken place, it has not been able to make such a clear-cut distinction between teachers trained through distance education and those trained through more conventional approaches (e.g. Taylor & Vinjevold 1998). It would seem, rather, that improving classroom practices is difficult and requires special attention even in situations where a substantial amount of teacher development time happens in a face-to-face context (Adler & Reed 2002; Mattson 2004). This means that we need to think about broad teacher curriculum issues, and in particular, the kinds of practices that are modelled as well as distance education issues.

What are the challenges of changing practices?

Novice teachers are often expected to engage in practices which have not been modelled in their own experiences as learners; and experienced teachers often find that the "new" practices being encouraged contradict and undermine their assumptions and values about the nature of teaching. This can lead to paralysis and even a decline in performance.

The rapid pace of technological change and increasing globalisation means that teachers can no longer be seen as the sole repositories of a fixed body of knowledge that merely needs to be transmitted into the empty heads of learners (probably this should never have been so). Slattery (2006:48-9), a curriculum specialist, observes:

> Teachers often agree that their students do not know the factual information required for passing through the school system and passing standardized tests, but they throw up their hands in desperation, blaming uninterested parents, boring textbooks, overcrowded classrooms, drugs, self-esteem programs, television, poor preparation, and ineffective previous teachers, or any other convenient target. However, these teachers continue to use the same methods of teaching and evaluation that have dominated curriculum development for over one hundred years ... Is the problem that educators have not perfected the modern methods? Or is the problem that the modern methods and strategies are no longer appropriate in a postmodern era?

Slattery (2006:111) argues the need for a more cooperative learning and teaching environment, an interdisciplinary school curriculum, seminar-style classes "where circles and centres replace rows of desks" and

> Discovery laboratories, multisensory projects, autobiographical narratives, oral history projects, engaging seminars, aesthetic awareness, and provocative field experiences involving groups of students, teachers, and other community members will become the norm rather than the exception. Socratic dialogue that seeks understanding, respect, and synthesis rather than predetermined answers will be the hallmark...

Below we have identified some key challenges to changing practices.

Pedagogical Content Knowledge

Teaching and learning approaches may be changing quite dramatically, but teachers' subject knowledge remains important in all curriculum approaches. Buckingham (2005:4) and Woolfolk (2006:88) point to US research which suggests that the only significant predictors of teacher quality are strength of subject matter knowledge (especially for secondary teachers) and teachers' own level of literacy. The US research suggests that pre-service teacher education courses and advanced education degrees are apparently unrelated to teacher effectiveness, and teaching experience is only significant for the first four or five years, after which there is little growth in effectiveness with each year in the classroom.

So while teachers' own mastery of their subject/learning area is essential, this needs to be unpacked a little more. In an extensive study in South Africa (Taylor and Vinjevold 1999) which involved observation of many teachers in many different classrooms, it was discovered that many teachers were making basic errors *in the curriculum they were required to teach*. Often these were teachers who had passed subject-content modules in a teacher development programme at a much higher level than that of the classroom curriculum they were required to mediate. How can we address this disparity?

In concluding a detailed study of an in-service programme in an evaluation process that required detailed and multiple observations and interviews that explored both theoretical knowledge and classroom practice, Adler, Slonimsky and Reed (2002:149) observed the following of the teachers who successfully completed the programme:

- All expressed increased confidence in themselves as teachers, and in many cases such increased confidence was observed.
- Teachers with a sufficient base of subject knowledge were able to benefit from the subject focus in the programme, though not always in ways that impacted directly on their teaching, with this impact being a function of both their present disposition and the context in which they worked.
- In contrast, teachers with a poor knowledge base struggled to rise to the demands of the programme and appeared to leave the programme with little added to their repertoire of subject teaching.
- This struggle appeared most acute where teachers were working in very impoverished contexts.
- All teachers struggled with syllabus content coverage in their subject, with sequencing and grading of tasks and with new approaches to knowledge.

On the basis of these findings, they suggest:

> We posit that the task that lies ahead is to characterise and articulate "subject knowledge for teaching" and to clarify how its acquisition by teachers lies in the co-ordination of subject, pedagogic and conceptual knowledge – or what can be renamed teachers' conceptual knowledge-in-practice. (Adler, Slonimsky and Reed 2002:151)

In other words, we would argue that before teacher-students enter a classroom, and before we have them working on advanced theoretical physics, we need first to have them engage with the curriculum they will be required to teach. We would

argue that although teachers may well have succeeded in their schooling at this level, this does not mean they have necessarily mastered the concepts that were covered, understand the conceptual progression across the phase in which they will specialise or will be able to mediate it in the classroom. It is possible, perhaps even probable, that school success was based on rote learning and a developed skill for answering test/exam type questions rather than deep conceptual learning. However, this should not be construed as an argument to simply rehash the school curriculum in the way that it was delivered in the classroom. Rather, as Adler et al, propose, it means getting teacher–students to engage with carefully scaffolded **problem-based activities.** An example of such an activity can be found in the annexure.

Activities like this which focus on the expected practice in the classroom help to revise teacher-students' own subject-specific conceptual understanding in ways that make a logical and integrated link with both methodology and understandings of learners and learning: the meaningful integration of theory and practice as opposed to the atomistic, decontexualised learning that characterises many teacher development programmes.

Fullan and Hargraves (1992, cited in Bertram, Foteringham & Harley 2000:264,266) identify three common approaches to teacher development and changing practice:

- The development of a teacher's knowledge and skills
- The development of a teacher's self-understanding
- A focus on the context in which the teacher works.

They suggest that in practice, all three approaches need to be combined if we wish to effect real change.

As Mays (2004:58-61) notes, the most motivating module or the most enlightening contact session will not on its own bring about the necessary change in educators' thinking and practice: personal experience suggests that the inspiration to change rarely outlasts the journey home from the workshop, and the pressures of day-to-day habits and routines tend to reassert themselves once educators are back in their classrooms and schools.

In recognition of this, Hopkins (1996 in Bertram et al. 2000:183) suggests that ideally a workshop (or contact session) involving the facilitation of key ideas and principles, modelling and demonstration and practice in non-threatening situations needs to be followed up by school-based support, to facilitate immediate and sustained practice, collaboration and peer coaching, as well as reflection and action research.

Dladla and Moon (2002) take this school focus further, however, and argue for a greater emphasis on **school-based training** which would include the following six key elements:

- The need for a clear articulation of the expected outcomes of training with a clear focus on the improvement of classroom practice;

- School-based support from more experienced educational staff (school inspectors, teacher trainers, experienced teachers working in school clusters are just three examples of where the support can come from);
- Clear assessment and quality assurance structures so that the teachers know what they have to do and the system is self-monitoring in terms of effectiveness;
- Materials resource support that explicitly guides the teachers in trying out and experimenting with improved strategies within the classroom;
- School and principal guidance to ensure that teacher training contributes not just to individual performance but to school improvement as a whole.

Moon (2006:23-24) subsequently argues for reforming curriculum in ways which:

- Focus the curriculum more, particularly where education and training opportunities are constrained, on core classroom skills and understanding, particularly pedagogies that are more effective in raising achievement: teacher education programmes, therefore, need to be conceptualised in ways that incorporate the daily life and work of the teacher;
- Rethink the period of time for initial training but providing opportunity for continuing professional development in-service;
- Exploit technologies.

Changing practice involves questioning value systems

The growing emphasis on a classroom focus to influence practice, not only acknowledges the diverse contexts in which people work, but also acknowledges that what actually happens in the classroom is influenced by the teacher's underlying beliefs about what constitutes good practice, and his/her personal value system. These influences are often innate rather than explicit and amount to what SAIDE's study of education series refers to as the teacher's 'theory in practice' or 'theory as practice'.

This often unarticulated theory-in-practice can result in tension in trying to bring about change in practice, through conflict with existing ways of doing things. For example, a teacher (or teacher trainer) whose implicit assumption is that learners do not bring anything to the learning experience and have nothing worthwhile to say is likely to adopt a traditional, teacher centred, content-based, summatively-assessed classroom (or DE materials or DE contact session) style and be uncomfortable with, perhaps even actively resist, a move towards the inter-disciplinary, activity-based, cooperative and collaborative learning and teaching strategies advocated by Slattery and required in some national policy documents such as South Africa's National Curriculum Statement (cf www.education.gov.za).

Prabhu (1990 in Bertram et al 2000:311-2) suggests that this internalised set of assumptions, beliefs and values built up over a period of time through classroom experience, training and other factors contributes to the development of the teacher's 'sense of plausibility' about what amounts to good or bad practice. When faced with a new approach, method or activity, the educator will have a sense of whether or not this will work for him/her in his/her context, without necessarily being

able to articulate or justify this position. Forced to implement the new approach, without the opportunity to try to understand the rationale for it and to reflect on his/her underlying assumptions, beliefs and values, the educator is likely to implement in an unmotivated and ill-thought-through way. This is likely to result in a negative experience and a self-fulfilling prophecy that will militate against any further attempts at innovation.

Lewin, in his overview of a multi-site study of six countries' pre-service training (2004), highlights the well-developed images trainees have of good primary teachers. These often resonate with essentially transmission-based modes of teaching, hierarchical learning of knowledge and conventional teacher-centred classroom organization. He observes that "these images can be contrasted with those found in recent curriculum literature which promotes more reflective and child-centred (rather than knowledge-centred) methods of teaching".

As Tabulawa (1997) notes, educators may not be prepared to engage with changes in practice that

> would have a destabilising effect on their taken-for-granted classroom world, possibly leading to deskilling and cognitive dissonance ... [In addition, as] Dalin predicted (and experience has vindicated him) ... many ... would ... experience difficulties in implementing these very same innovations since their success or failure would be influenced by factors beyond the reach of the educational system – factors such as cultural traditions, traditional authority structures, parental expectation, etc. (in Bertram et al. 2000:297-309)

Thus if the intention is to prepare teachers adequately to embrace and implement changed practices in their classrooms, then it is necessary to help them explore not only their own underlying values and beliefs, but also those of their learners and the community and society of which the school forms a part. In short, as Tabulawa (ibid) says: "*teaching is not just a technical activity whose solutions require technical solutions*". A teacher development programme also needs to speak to the educators' beliefs and values and these are likely to reflect those of the broader society of which the teacher is a part (Mattson 2004:33-37).

Sadly, it is SAIDE's experience that many teacher education programmes, materials, assessments and contact sessions are focused on delivery and testing content rather than grappling with these more complex issues. As noted in the ADEA report of 2004, in general, investment in thorough curriculum design is limited in many institutions.

Modelling practice

Modelling practice in a teacher development programme offered by a higher education institution through distance education is two-fold – it requires modelling appropriate learning through distance education and modelling appropriate teaching practices that can be integrated into the classroom.

Moll (2003:21-2) argues:

> In distance education, the central problem becomes one of how best to create a situation in which learners are able to engage in and be supported in a particular, unfamiliar activity – a knowledge practice – without having to be in the constant presence of practitioners of that activity ... [Hence}

> The texts, learning guides and structured activities of a distance programme, together with judiciously spaced and used contact sessions, must provide a practice-in-itself.

Unfortunately, it is SAIDE's experience that curricula, assessment, materials and face-to-face contact often model inappropriate practice. Often it is assumed, incorrectly, that teacher-students have the necessary literacy skills to make meaning from printed texts, especially ones that have been "designed" for distance education and no support is offered to bridge the transition from classroom-based and often teacher-centred approaches, to independent learning.

A move towards team planning, team assessment, team teaching and team support advocated in course materials, required by course assignments and modelled in the ways in which the institution interacts with its teacher-students, through observation, feedback and guided critical reflection, and the ways in which materials, assessment and support scaffold critical reflection should further help teachers to articulate and question some of their taken-for-granted assumptions (Beets & le Grange 2005; le Grange 2005; Leibowitz, Booi, Daniels, Loots, Richards & van Deventer 2005).

Acknowledging the diverse contexts of teaching and learning

According to Lewin (2004), nationally grounded pedagogic content knowledge is widely unavailable so some key dimensions such as teaching large classes, multi-grade classes, code switching, etc are often missing from teacher education courses.

Similarly he notes that for education studies, reliance is placed on material from external sources. So for example the 'method books' used are often those published internationally, and lectures notes are often drawn from overseas courses.

In a similar vein, teaching programmes will often advocate experimentation and innovation but trainee teachers end up doing their teaching practice in a school that is dysfunctional and actively resists any attempts at innovation. Identifying and managing a network of schools appropriate for teaching practice becomes extremely difficult: does one choose school for teaching practice that are functional and encourage innovation, knowing that trainee teachers are likely to end up in authoritarian and possibly dysfunctional schools. This complex balancing task requires much ingenuity and time. Very often institutions do not have the staff available to fulfil this role.

Emerging curriculum practices in Africa

There are a number of innovative programmes that are in operation in Africa from which we can derive inspiration. We will identify a few:

The University of Fort Hare in South Africa developed a distance education teacher development model based on partnership between the University (which provided academic development and support) and the Department of Education (which

provided work-place-based support) which bears further examination (SAIDE 2001) and seems to exemplify many of the new curriculum approaches advocated earlier in the paper. The Fort Hare programme developed materials that were built around practical classroom-based problems and challenges, offered regular in-school and out-of-school support in which the focus was on cooperative and collaborative learning rather than delivery of content and assessment practices that foregrounded issues such as self-assessment, commitment and evidence of improved practices in the classroom.

In a joint presentation to the Nadeosa 10-year anniversary conference in Pretoria in 2006, Sankale, Limozi and Welch report on a school-based teacher development initiative in Kenya. The move towards a school-based distance education approach was a deliberate choice on the part of the Ministry of Education, Science and Technology:

The intervention was as a result of:-

- **SPRED I (Strengthening Primary Education)**
  - **Limited impact at the classroom level as a result of the weaknesses in the cascade system of training**
  - **Pupils opportunity cost**
  - **Non-mainstream**
- **National baseline survey**
  - **Limited pedagogic approaches**
  - **Low achievements in Science, Maths and English**
  - **Limited in-service training opportunities**
- **Size of system**
  - **6.2 million pupils, 17 500 schools, 180 000 teachers, GER of 87% steadily rising as a result of policy of Free Primary Education**

The nature of the school-based initiative is summarised in the following slide:

School based Teacher Development Programme (SbTD)

- **Five month in-service programme for primary school teachers**
- **Focusing on key subjects: Maths, Science and English**

Aims

- **The main aim of the SbTD programme is to develop reflective primary school teachers who are willing to challenge their own ideas about teaching. The teacher is encouraged to try out different teaching strategies. These strategies should motivate and challenges all pupils.**
- **SbTD trained teachers will lead school-based professional development in their subject area in the school. This approach will facilitate the training and support of primary school teachers in the country.**

The impressive achievements of this school-based distance education initiative were as follows:

Achievements of the programme

- **Developed 54 000 key resource teachers (or 29% of teaching force) over 3 three years**
- **Trained 1,200 Teachers Advisory Centre Tutors (TACs) in DE support methods**
- **Trained 1,000 zonal and national education school inspectors to undertake monitoring, evaluation, and quality assurance of the SbTD programme**
- **Teacher reading rates increased**
- **Teacher morale improved**

 Throughput rate of 87%

Moon (2006:22-23) identifies several other important initiatives in other parts of Africa including:

- The National Teachers Institute (NTI) in Nigeria which has introduced a 15-month long ODL-based preparation programme with a three-month internship to get new teachers into classrooms who are then encouraged to follow a school-based programme to achieve the National Certificate of Education (NCE) whilst in-service.
- The Open University of Sudan which has made use of growing connectivity in the country to provide an increasing array of on-line development opportunities.

What is needed for effective teacher education through distance education?

Based on the previous discussion, we suggest:

- A clear vision of the kind of teacher we want to develop
- A clear understanding of the contexts in which teachers work and commitment to developing appropriate T&L environments and providing ongoing support
  (HEIs AND DoE etc.)
- Purpose-driven programme design informed by postmodern perspectives and the reality of a globalised society and informed decisions about media and roles
- Programme delivery that models appropriate practice
- Ongoing evaluation and impact analysis to inform programme review that is budgeted for
- Greater collaboration.

A clear vision of the kind of teacher we want to develop

In most instances it is expected that distance education will need to be introduced by staff who teach in full-time, contact-based programmes and institutions. The move to distance education necessarily means that, perhaps for the first time, the practices of such institutions will be captured in public documents open to public scrutiny. This suggests that a decision to move into distance education provision also represents a good point at which to take stock, to examine theoretical assumptions underpinning current practice and to re-examine the vision and mission to ensure they are sufficiently present-based and future directed.

This will involve academic staff in a process of imagining the kind of teacher they need to develop and reflecting upon the kind of teaching practices they themselves exemplify in the approaches they take in the materials they write, in the assessment tasks they set and the ways in which they engage with teacher-students

in person or via technology. Are we transmitters of information or co-constructors of learning – or maybe something in between?

After a lengthy process of national consultation, The South African Department of Education identified seven teacher "roles" that need to inform all teacher development programmes in South Africa: curriculum developer, assessor, mediator/teaching and learning specialist, manager and administrator, professional with pastoral/community role, scholar and subject, learning area or phase specialist (RSA 2000; RSA 2007).

A clear understanding of and support for the contexts in which teachers work

The environments in which many teachers have to work and learners have to learn are often not optimal for learning. Some things can be addressed through an appropriately designed distance education intervention but a certain minimum level of school infrastructure needs also to be in place to make it possible for better teachers to perform better.

Often classroom resources for teachers and learners are very limited. This is an area in which a well-designed distance education programme can be very beneficial by making sure that the teacher, at least, has a copy of the syllabus, sufficient resources to cover the school-based curriculum (even if suggested activities need to be written on a chalkboard for example because the school has no duplication facilities) and, perhaps most importantly, the teacher is helped to identify and adapt everyday resources available in the community.

Experience also suggests that teachers often work in isolation from one another instead of exploiting and sharing their joint strengths: a distance education programme that recruits students in pairs, school teams and/or clusters; which requires team work in in-text activities and assignments; provides guidelines and support for student-led study groups and offers occasional face-to-face contact sessions at which cooperative and collaborative teaching and learning are modelled can go a long way towards breaking down the barriers between individual teachers, classrooms and schools.

Both pre- and in-service teacher-students often complain that authoritarian school leadership militates against innovation in the classroom; so perhaps a large scale classroom teacher development programme should be complemented by a large-scale school- and district- leader development programme which will make clear the need for innovation and the desirability of distributed leadership practices.

In some instances, teacher development programmes offered by higher education institutions (HEI) are seen as separate, and occasionally competing, activities from/with those of the Ministry. For example, an HEI has to quickly re-schedule a planned contact session because the Ministry has decided to run a workshop on the same day or the HEI has asked teacher-students to experiment with a new teaching approach and this is roundly condemned by a visiting Ministry official who is not him/herself familiar with this practice. A common national vision and set of expectations captured in national policy and a Ministry developmental appraisal approach that reinforces what HEIs have taught, between school visits and contact sessions, could go a long way towards mitigating such conflicts and strengthening the take-up of new practices.

Innovations of this nature are usually not short term. Bloch (2008) suggests that education innovation of this nature requires a national vision and commitment and a thirty-year plan. However, as our colleagues in Kenya have shown, we can achieve some pretty amazing results in shorter-term initiatives as well.

Purpose-driven programme design informed by postmodern perspectives and the reality of a globalised society

As noted previously, the planned curriculum (actually more often a planned 'syllabus') in many countries adopts a one-size-fits-all approach that sometimes seems to militate against improved classroom practices by over-emphasizing other issues such as the take-up of post-school content knowledge (which itself is sometimes not assessed in ways that require conceptual mastery) or the production of some kind of formal research report or dissertation. Apart from the loss of focus on the quality of classroom practice, such programmes also tend to be much longer to complete – requiring at least 4-5 years of full-time study and 8-10 years of part-time study while working. Not surprisingly, throughput in such programmes tends to be very low (if tracked at all) and of the few successful graduates, many will graduate only to leave the classroom and find a much better paid job and much better working conditions elsewhere. Four to ten years of teacher development then becomes a very expensive way of training an economist or laboratory assistant or an entrepreneur. Better student counselling on registration could have resulted in more informed choices being made.

Other issues we need to address in designing curricula include:

- Is the programme for IPET (in which case we would expect students to reflect on their experiences as learners) or CPET (in which case we would expect students to reflect on their experiences as teachers and to try out new things in the classroom immediately)?
- Is the programme targeted at primary school teachers (who usually teach an integrated school curriculum and would therefore probably benefit most from an integrated teacher development curriculum) or secondary school teachers (who teach a more subject-based curriculum and who would probably benefit most by completing a standard undergraduate BA, BSc, BCom and then having the option of an additional one year PGCE)?
- Are teachers working in well- or low-resourced learning environments? This would affect whether our emphasis is on adapting available resources or including more ready-made resources in the distance education course pack.
- What are the prior learning experiences of learners and teacher-students? What levels of literacy, numeracy and critically reflective thinking can be assumed, for example? How can we develop activities that start from where learners really are, making it possible for them to link new learning to existing schema and to work through Vygotsky's 'zone of proximal development'?
- What should be the language(s) of learning and teaching? Is code-switching acceptable practice?

- Does assessment value knowledge or practice? Or both – in equal or different measures?
- Is the purpose of the programme to develop the individual teacher or to improve the performance of school learners? Or both? Or something else? Does the focus change as teacher-students work through the programme?
- How much of the 'what' and 'how' of teaching do teacher-students need to have mastered before we could let them work in a classroom (and then possibly completed their studies while in-service)?
- What technologies are best suited to the achievement of what kinds of learning outcomes e.g. text for content, video (on VCR or DVD) or face-to-face contact for modelling practice, mobile technology for administrative reminders and short academic inputs?

However we answer questions like the above, Moon (2006:iv) asserts that "... the coming decade will see the inevitable expansion of school-based teacher education programmes requiring new and innovative modes of delivery" while Morrison and Pitfield (2006:188, 192) argue for some flexibility in course entry and exit points, for self-study modules with negotiated deadlines, flexible start dates, the possibility of extended time, recognition of prior learning and exploration of the implications for tutors' teaching beliefs and workload factors.

Programme delivery that models appropriate practice

Ideally, we would suggest that a teacher development programme offered through distance education should 'practise what it preaches'.

If the programme argues for a blend of independent as well as cooperative and collaborative learning approaches in the classroom then this is what should be valued in the programme in the way that in-text activities and assessment tasks are set and in the ways in which face-to-face or technology mediated contact is conducted.

Hopper and Sanford (2004:61) comment on a particular approach which they describe as follows:

> The curriculum of the course began to develop in response to the students' own needs and interests, incorporating assignments that required the students to research, collaboratively plan and teach, explicitly recognize their learning through observing and acting, and share their knowledge in public forums.

Ibid 63

> The inclusion of the school experiences within the university course created a recursive process for the students whereby the school context caused a "make you think" or cognizant effect that inspired and stimulated the student teachers into a sense of dissonance with their previous assumptions.

Ibid 71

> School integrated teacher education courses contrast with many current teacher education programs based in a positivist tradition, where discrete

courses are offered, fragmented between departments, with little or no connection to field experiences (Grimmett, 1998; McWilliam, 1994; Zeichner, 1999).

Other issues that need to be addressed are developing practices for meaningful resource-based learning, contextualised learning, the valuing of learners' own knowledge and experience, exposure to multiple perspectives and the appropriate scaffolding of learning and teaching processes.

Ongoing evaluation and impact analysis to inform programme review that is budgeted for

Robinson notes that ongoing evaluation and impact analysis of teacher education programmes is generally weak and that these weaknesses are exacerbated by the complexities of distance education delivery: "Most reports are largely descriptive, only sometimes including detailed statistics and often lacking well-evidenced findings on outcomes ... However, some problems arise specifically from the nature of distance education: its scale, distribution of learners, tutors and schools, range of stakeholders and partners responsible for different tasks" (Robinson 2003:196-7).

We would argue the need for site-based assessment and support (which may require decisions about sampling strategies in large-scale programmes), a focus on quality of teaching against agreed criteria, the dovetailing of programme assessment and Ministry developmental appraisal processes and the use of data from such processes that leads to revision of programme design and delivery that is catered for in the programme budget.

Greater collaboration

Apart from the practices modelled in the programme, we would make a strong plea for enrolment in school teams and school clusters, concerted efforts to guide and support student-led study groups and greater HEI/MoE collaboration than has been the case in the past – not just with programme design but also with programme support for improved practice. a detailed study of the use of distance education for primary teacher training in African schools, notes that successful students can become a foundation for continued school-based professional development (Mattson 2004:6), but cautions about the need to encourage practical problem-solving and professional socialisation and to guard against entrenching poor practices (Mattson 2004:11). Although mentoring is gradually being accepted as a teacher role in this respect, some resistance is reported e.g. in Zambia, Malawi and Gambia, especially where "allowances" are involved (Mattson 2004:12). Alternative 'rewards' could rather be in the form of reduced teaching loads and clearly there is a need for monitoring of school-based support. The particular context needs always to be borne in mind: in Malawi and Zambia, for example, "... schools function poorly as training sites because of the scarcity of basic resources and the lack of support from mentors and other teachers." (Mattson 2004:12)

Mattson concludes that in sub-Saharan Africa there is an emerging new pattern of teacher education reform that sees a number of common trends. Most importantly, these include:

- The gradual integration and rationalisation of teacher education systems linking ministry, universities, colleges, districts, resource centres, local support

cadres, schools and communities in the provision of standardised, accredited training along a Preset-Inset continuum;

- The adoption of flexible ODL methods, creating new roles and responsibilities among existing providers and devolving training and support functions to district, zone and school levels;
- Reliance on print-based materials and, despite the ambitions and rhetoric of some donors and ministries, very little use of ICT-enhanced programmes. (Mattson 2004:15)

With so many role players increasingly involved in teacher development, there is need to guard against possible loss of coherence and cohesion.

An additional area to be considered is a commitment to the development and use of Open Education Resources (OERs) as exemplified in the Teacher Education in Sub-Saharan Africa (TESSA) project.

> The TESSA Materials are focused on classroom practice in the key areas of literacy, numeracy, primary science, social studies and life skills. They are designed for teachers to use in the classroom, as party of activity-based learning ... Teachers, as pupils, are supported in this process by the Teacher Educators in institutions, so they are useful resources for Teacher Educators too.
>
> ... Each section has a case study ... about a topic, and also an activity. The case study and the activity give you ideas about different ways you could deal with a topic, but they are not exactly lesson plans. You, or the teacher, have the freedom to implement the ideas in your own way. But of course they are promoting active learning in schools. (TESSA c.2007)

However, we need to offer support and training in how to use existing resources. Adler, Reed, Lelliott and Setati (2002:69), having explored issues related to the availability and use of resources in an in-service teacher develop programme, comment on

> the unsettling understanding ...: that *in contexts of greatest need* the teachers' appropriation from their in-service experiences and the recontextualisation of new or existing resources exacerbated inequality. There were teachers whose context and/or personal disposition appeared to work against pedagogic innovations, and in these cases an unintended consequence of innovation appeared to be both an undermining of the teacher's resourcefulness, and consequently reduced learning opportunities for his or her learners. [italics as in original]

This echoes the concerns of Prabhu and Tabulawa mentioned earlier.

Adler, Lelliot and Setati argue that when discussing teachers' access to and use of resources, it is useful to think in terms of issues related to transparency, recontextualisation and appropriation which they explain as follows:

- Access to any social practice ... entails access to the resources of that practice. Such access hinges on the concept of *transparency* with its dual functions of visibility and invisibility (Lave & Wenger, 1991). Access to a resource in a practice requires that the resource be both visible (seen so that it can be used) and invisible (see through so that the practice is illuminated). For example, effective use of a geoboard in a mathematics class means seeing the nails, and seeing through the nails to the spatial relationships between them. (ibid. 59)

- The difficulty with a resource like a sheet of paper is that as it is drawn into the classroom, it is recontextualised. It is no longer a sheet of paper: within a mathematics lesson on fractions it could stand for a "whole"; in a science lesson it could represent the end product of a paper-making process ... The meanings of the resources emerge through their use in the context of the classroom practices and the subject knowledge being learned. (ibid. 68-9)

- Interrogations of learning, particularly from a socio-cultural perspective , have helped explain unevenness and heterogeneity by shifting away from cognitive science notions of internalisation (a simple taking in of the external), to appropriation – where tools in the learners' environment are understood as being used adaptively (Kirshner & Whiston, 1997:5). There is an ongoing interrelation between the learners' biographies, their learning in the programme, and the context in which they work. (ibid. 69)

Concluding remarks

Distance education can and should be used for teacher development provided this is done in ways that add quality and result in improved learning in classrooms. Distance education decisions are first and foremost education decisions thus we should be asking:

- What is educationally the best way to bring about this desired learning outcome?

- Now how can we do this without necessarily requiring teacher-students and teacher trainers to be in the same place at the same time?

- How will we know whether we have achieved our purpose and what will we do if we have not?

References

Adler, J. & Reed, Y. Eds. 2002. *Challenges of Teacher Development: An investigation of take-up in South Africa*. Pretoria:Van Schaik.

Adler, J., Reed, Y., Lelliott, T. & Setati, M. 2002. Chapter 4 Availability and use of resources: a dual challenge for education in Adler, J. & Reed, Y. Eds. 2002. *Challenges of Teacher Development: An investigation of take-up in South Africa*. Pretoria:Van Schaik. 53-71

Adler, J., Slonimsky, L. & Reed, Y. 2002. Chapter 8 Subject-focused INSET and teachers' conceptual knowledge-in-practice in Adler, J. & Reed, Y. Eds. 2002. *Challenges of Teacher Development: An investigation of take-up in South Africa*. Pretoria:Van Schaik. 135-152

Association for the Development of Education in Africa (ADEA). 2002. *Open and Distance Learning in sub-Saharan Africa: A Literature Survey on Policy and Practice*. Mauritius:ADEA WGDEOL.

Association for the Development of Education in Africa (ADEA). 2004. *Distance Education and Open Learning in Sun-Saharan Africa: Criteria and Conditions for Quality and Success Factors. A Survey of Policy and Practice. Draft Working Document tabled at the Sub-Regional Conference on Integration of ICT in Education for West Africa. Developed by SAIDE*. Available at www.adeanet.org/wgdeol/publications

Association for the Development of Education in Africa (ADEA). 2005. Costing *Distance Education and Open Learning in sub-Saharan Africa: A Survey on Policy and Practice*. Mauritius:ADEA WGDEOL.

Beets, P. & le Grange, L. 2005. 'Africanising' assessment practices: Does the notion of ubuntu hold any promise? *South African Journal of Higher Education (SAJHE) 19 (Special Issue), 2005*. 1197-1207

Bereiter, C. 2002. Education and Mind in the Knowledge Age. Mahwah, NJ:Lawrence Erlbaum.

Bertram, C., Fotheringham, R. & Harley, K. 2000. *Curriculum Studies*. Pietermaritzburg:UNP.

Bloch, G. 2008. 'Fixing education is a 30-year task', *The Cape Times*, March 13, 2008, p.9. Access at www.iol.co.za on 03/17/2008.

Buckingham, J. 2005. Good Teachers Where They Are Needed. *Issue Analysis*, 64, 19 October 2005 available at www.cis.org.au.

Council on Higher Education (CHE). 2004. *South African Higher Education in the First Decade of Democracy*. Pretoria:CHE.

Craig, H. & Perraton, H. 2003. Chapter 5 Open and distance education for teachers' continuing professional development in Robinson, B. & Latchem, C. Eds. 2003. *Teacher Education Through Open and Distance Learning. World review of distance education and open learning Volume 3*. London/New York:Routledge Falmer/COL. 91-111

Creed, C. 2001. *The Use of Distance Education for Teachers.* Report for DfID. Cambridge, International Research Foundation for Open Learning.

Dladla, N. & Moon, B. 2002. *Challenging the assumptions about teacher education and training in sub-Saharan Africa: a new role for open learning and ICT.* Paper presented to the Second Pan-Commonwealth Forum on Open Learning, ICC, Durban, South Africa, July 29th – 2nd August, 2002.

Global Campaign for Education (GCE). 2006. Teachers for All: What governments and donors should do. Cited in Moon, B. 2006. *Research analysis: A global overview of current policies and programmes for teachers and teacher education – Prepared for the joint ILO/UNESCO Committee of Experts concerning Teaching Personnel*. Milton Keynes:OUUK.

Hopper, T. & Sanford, K. 2004. Representing Multiple Perspectives of Self-as-Teacher: School Integrated Teacher Education and Self-Study. *Teacher Education Quarterly*, Spring 2004, 57-74.

Jeeroburkhan, M. F., Muganda, C. K., Mays, T., Holomisa, T. & Posthuma, B. 2006. *Case Studies of Teacher Education Programmes Run by DEOL in Selected sub-Saharan African Countries – Prepared for the ADEA Working Group on Distance Education and Open Learning*. Unpublished.

Le Grange, L. 2005. The 'idea of engagement' and 'the African University in the 21st century': Some reflections. *South African Journal of Higher Education (SAJHE) 19 (Special Issue), 2005*. 1208-1219

Leibowitz, B. L., Booi, K., Daniels, S., Loots, A., Richards, R. And van Deventer, I. 2005. The use of educational biographies to inform teaching and learning in an African University. *South African Journal of Higher Education (SAJHE) 19 (Special Issue), 2005*. 1220-1237.

Lewin, K 2004. *ThePre-Sevice Training of Teachers – Does it meet its objective and can it be improved?* – Background paper prepared for the Education for All Global Monitoring Report, 2005, UNESCO.

Mattson, E. 2004. *Distance Education for Primary Teacher Training – Case Studies of Student Support Systems from sub-Saharan Africa. Report for the Department of International Development: Contract Number ED2002/01.* Cambridge:International Research Foundation for Open Learning (IRFOL).

Mays, T. 2004. *From policy to practice: an evaluation of the Unisa National Professional Diploma in Education from the perspective of social critical theory. MEd dissertation*. Unisa. Unpublished.

Mays, T. 2005. Costing distance education and open learning in sub-Saharan Africa. *Open Learning, 20(3)*. 211-225

Moll, I. 2003. *What is a Learning-Centred Learning Centre? Key Questions for Distance Education*. Johannesburg:SAIDE.

Moon, B. 2006. *Research analysis: A global overview of current policies and programmes for teachers and teacher education – Prepared for the joint*

ILO/UNESCO Committee of Experts concerning Teaching Personnel. Milton Keynes:OUUK.

Morrison, L. & Pitfield, M. 2006. Flexibility in initial teacher education: implications for pedagogy and practice. *Journal of Education for Teaching*, 32(2), May 2006, 185-196.

New Economic Plan for African Development (NEPAD). C.2006. *Teacher training and teacher development through open and distance learning in Africa, Chapter 1 of a Draft Report*. Pretoria:NEPAD.

Oliveira, J. B. & Orivel, F. The costs of distance education for training teachers. In Robinson, B. & Latchem, C. Eds. 2003. *Teacher Education Through Open and Distance Learning. World review of distance education and open learning Volume 3*. London/New York:RoutledgeFalmer/COL. 212-233.

Perraton, H. 2000. *Open and distance learning in the developing world*. London:Routledge.

Prabhu, N. S. 1990. There is no best method – why? *TESOL Quarterly, 24(2),* 117-133.

Republic of South Africa (RSA). 2000. Norms and Standards for Educators. *Government Gazette No. 20844, February, 2000*. Pretoria:Government Printer.

Republic of South Africa (RSA). 2007. The National Policy Framework for Teacher Education and Development in South Africa. *Government Gazette, 26 April 2007, No. 29832*. Pretoria:Government Printer.

Robinson, B. 2003. 10. Evaluation, research and quality in Robinson, B. & Latchem, C. Eds. 2003. *Teacher Education Through Open and Distance Learning. World review of distance education and open learning Volume 3*. London/New York:RoutledgeFalmer/COL. 193-211

Robinson, B. & Latchem, C. Eds. 2003. *Teacher Education Through Open and Distance Learning. World review of distance education and open learning Volume 3*. London/New York:RoutledgeFalmer/COL.

Sayed, Y. 2006. *Mapping Regional Teacher Education Initiatives in Africa: Critical Policy Challenges. A survey undertaken on behalf of NEPAD*. Pretoria:NEPAD Education Desk.

Sharma, R. C. 2005. *Open learning in India: evolution, diversification and reaching out*. Open Learning, 20(3). 227-241.

Slattery, P. 2006. *Curriculum Development in the Postmodern Era. Second Edition*. New York/Abingdon:Routledge, Taylor & Francis Group, LLC.

Smith, I., Brisard, E. & Menter, I. 2006. Models of partnership developments in initial teacher education in the four components of the United Kingdom: recent trends and current challenges. *Journal of Education for Teaching*, 32(2), May 2006, 147-164.

South African Institute for Distance Education (SAIDE). 2001. *Teacher Education in Rural Areas. Report prepared for the Kellogg Foundation*. Joahannesburg:SAIDE.

South African Institute for Distance Education (SAIDE). 2006. *A Distance Education Evaluation of the Kigali Institute of Education Distance Training Programme, undertaken by Tony Mays and Christine Randell, Final Report*. Joahannesburg:SAIDE.

South African Institute for Distance Education (SAIDE). 2008. *SAIDE Open Educational Resources Project. Teaching and Learning Mathematics in Diverse Classrooms. Pilot Version. May 2008*. Johannesburg: SAIDE.

South African Universities Vice-Chancellor's Association (SAUVCA). 2003. *Learning delivery models in Higher Education in South Africa. SAUVCA Occasional Paper, July 2003*. Pretoria: SAUVCA.

Tabulawa, R. 1997. Pedagogical Classroom Practice and the Social Context: The Case of Botswana. *International Journal of Educational Development, 17(2),* 189-204.

Taylor, N. & Vinjevold, P. Eds. 1999. *Getting learning right: report of the President's Education Initiative Research Project*. Johannesburg: Joint Education Trust.

Teacher Education in Sub-Saharan Africa (TESSA). c.2007. *TESSA Teacher Educator Guidance*. Unpublished draft document.

Welch, T. & Reed, Y. Eds. 2005. *Designing and Delivering Distance Education: Quality Criteria and Case Studies from South Africa*. Johannesburg: Nadeosa.

Welch, T. 2007. *A Teacher education Curriculum for Distance Learning*. Paper presented at the Unisa Teacher Education conference at Unisa, Pretoria on 2nd April, 2007.

Woolfolk, A. 2007. *Educational Psychology. Tenth Edition*. Boston:Pearson Inc.

Annexure

Activity 6: Problem-solving: number pattern activity

Reflect on the method and solution given in this activity to the following problem:

Ten cities in South Africa need to be directly connected to all other cities by a telephone line. How many direct connections are needed? (Paling & Warde: 1985).

One approach would be to follow the three steps given below – but you are at liberty to use any other problem-solving techniques. . If you try this problem out with one of the classes that you are teaching, it will be interesting for you to observe the different strategies that your learners use. Remember not to guide them too closely, let them think the question through and think of how to go about drawing it up and finding the solution.

Step 1: UNDERSTAND THE PROBLEM: e.g. three or more cities are not situated in a straight line. What do we need to do about it? We need to make sure that every one of the ten cities is connected by a line, which we will use to represent a telephone connection.

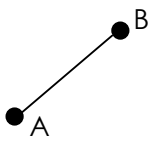
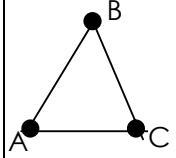
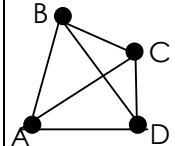
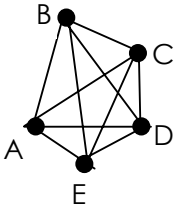
Reflection: To carry out this step the learners need to have the language skills to read and interpret the problem, they need to be able to visualise the problem, and then use their mathematical knowledge to move into the next step in which they represent the problem symbolically and numerically.

Step 2: DEVISE A PLAN: Reduce the problem to simpler terms –start with one city, and then two cities, three cities and so on.

Reflection: To carry out this step the learners need to use their mathematical knowledge to think about how to represent the problem symbolically and numerically. Here learners also need to use strategic reasoning. The idea to develop a pattern by building up the number of cities from one, to two, and then three, and so on, is essential to the solution to this problem. This is where we see the pattern element of the problem coming through.

Step 3: CARRY OUT THE PLAN: Use drawings and write dawn a sequence to establish the pattern, formulate conjectures, test conjectures and generalise.

Using drawings:

Number of cities	1	2	3	4	5
Drawing					

Number of connections	0	1	3	6	10
Establishing a pattern (rule)	0	0 + 1	0 + 1 + 2	0 + 1 + 2 + 3	0 + 1 + 2 + 3 + 4
	$\frac{1(1-1)}{2}=0$	$\frac{2(2-1)}{2}=1$	$\frac{3(3-1)}{2}=3$	$\frac{4(4-1)}{2}=6$	$\frac{5(5-1)}{2}=10$

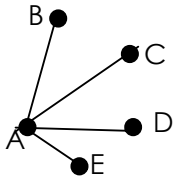
Reflection: To carry out this step the learners need to use their mathematical knowledge to represent the problem. Here they will use procedures and skills that they have been taught, but they will need to reason about the way in which they apply this knowledge. They will think about doing drawings of the first few cases, but as soon as they can see that there is a pattern emerging, they need to analyse the nature of the pattern. They can base their final solution on the basis of this pattern, by using the same reasoning to find the total number of connections of 6 cities, 7 cities..., and finally 10 cities. (Use drawings and test your conjecture/rules). When they do this, they are moving onto the next step.

Step 4: EVALUATE AND EXTEND THE PLAN FOR *n* CITIES: If there are *n* cities how many connections will there be?

Let us use a simpler example again.

For 5 cities

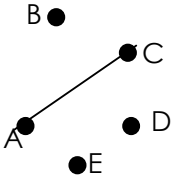
Each city will be connected to 4 other cities i.e. (5 – 1) = 4



There will be five such cases i.e. from A, B, C, D and E.

From this we have 5 (5 – 1) connections

The connection from A to C is the same as C to A.



This is the same for each case. So divide by 2.

We therefore get $\frac{5(5-1)}{2}=10$

Now write down the number of connections for *n* cities.

This would give us $\frac{n(n-1)}{2}$ as a formula to work out the number of connections between *n* cities.

For 10 cities we therefore get $\frac{10(10-1)}{2} = 45$

Reflection: The solution of this problem illustrates the idea that mathematics can be seen as the "science of pattern and order". The pattern was established though drawings made of the connections between up to five cities. Using the drawings, a numeric pattern could be established, which could be used to work out how many connections there would be between ten cities. Learners will not all follow the same steps, or carry out the steps in the same order. As the teacher, you need to be flexible, and follow the learners' thinking. You need to probe and guide, without leading too explicitly, so that the learners are able to make connections and develop their mathematical understanding, in short, so that they can be involved in "doing mathematics". (from SAIDE 2008:18-19)