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Multi-Site Teacher Education Research Project

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Discussion Paper 26

Turbulence or Orderly Change? Teacher Supply and Demand in South Africa – Current Status, Future Needs and the Impact of HIV/Aids

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Multi-Site Teacher Education Research Project (MUSTER)

MUSTER is a collaborative research project co-ordinated from the Centre for International Education at the University of Sussex Institute of Education. It has been developed in partnership with:

- The Institute of Education, University of Cape Coast, Ghana.
- The Institute of Education, The National University of Lesotho.
- The Centre for Educational Research and Training, University of Malawi.
- The Faculty of Education, University of Durban-Westville, South Africa.
- The School of Education, The University of the West Indies, St. Augustine's Campus, Trinidad.

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MUSTER is focused on generating new understandings of teacher education before, during and after the point of initial qualification as a teacher. Its concerns include exploring how new teachers are identified and selected for training programmes, how they acquire the skills they need to teach effectively, and how they experience training and induction into the teaching profession. The research includes analytical concerns with the structure and organisation of teacher education, the form and substance of teacher education curriculum, the identity, roles and cultural experience of trainee teachers, and the costs and probable benefits of different types of initial teacher training.

MUSTER is designed to provide opportunities to build research and evaluation capacity in teacher education in developing countries through active engagement with the research process from design, through data collection, to analysis and joint publication. Principal researchers lead teams in each country and are supported by three Sussex faculty and three graduate researchers.

This series of discussion papers has been created to provide an early opportunity to share output from sub-studies generated within MUSTER for comment and constructive criticism. Each paper takes a theme within or across countries and offers a view of work in progress.

MUSTER South Africa

Revised versions of the South African papers in this series can be found in the book **Changing Patterns of Teacher Education in South Africa – Policy Practice and Prospects, edited by K.M.Lewin, M.Samuel and Y.Sayed, (Heinemann Press 2003).** The book explores policy and practice in Teacher Education in South Africa and their implications for the future, representing one of few empirically grounded, policy orientated studies of teacher education in South Africa. The research presented covers critical topics of interest to those who prepare teachers and study teaching: the evolving histories of teacher education policy, shifting teacher identities, teacher supply and demand, contrasting models of teacher education delivery, college mergers and rationalisation, and the impact of HIV/AIDS on teachers and on teacher provisioning.

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ACRONYMS AND ABBREVIATIONS

OHS	October Household Surveys
PERSAL	Personnel database of the South African state
REQV	Relative Education Qualification Value
SGB	School governing bodies

1. OVERVIEW

This paper[1] explores five aspects of the factors that are shaping the supply and demand for teachers in South Africa. First it charts the nature of the South African teacher force and changes that have taken place in its composition since 1995. Second, it profiles patterns of income amongst teachers and makes comparisons with the labour force as a whole. Third, an analysis is presented of the characteristics of teacher turnover. Fourth some forecasts of teacher demand are generated under a variety of assumptions. Fifth, attention is drawn to the implications that flow from the uneven incidence of HIV/AIDS on teacher supply and demand. The last section draws together conclusions from the various analyses that are relevant to future teacher education policy.

The insights that are reported below are derived from the best data available to national government. There are many limitations to this data and its analysis and various techniques have been used to recognise these and generate confidence in the conclusions reached. These are discussed in detail in the monograph produced for the Department of Education on which this paper is based.

The picture that emerges from the analysis provides insights into current status and future needs that is not accessible through any other methods. It draws attention to the current status of the teaching force, how it is changing, and how it may need to change to meet new demands. It also identifies some characteristics of teachers that may not be widely appreciated and which contradict some commonly held assumptions.

In brief, the analyses suggest that:

1. Relative to the labour force as a whole, those employed as teachers are more feminine, work fewer hours, have much higher incomes, are more educated, are more unionised, and are increasing in age. Perhaps surprisingly since 1995 white participation in the teaching labour force has increased relative to participation in the working labour force as a whole, whilst that of Africans either decreased, or stayed constant in the teaching force, but increased in the rest of the working labour force.

2. South Africa's education labour market has not been as turbulent as much public debate has suggested, at least in comparison with what we forecast for the future and in comparison with other countries. Entry and exit rates were relatively low by the late 1990s and followed fairly predictable patterns. Being a teacher, if one is young and not well educated, is relatively attractive, but if one is well educated and middle-aged, being a teacher is relatively unattractive.

[1] This paper was originally commissioned by the Department of Education, Pretoria. Funding was provided by USAID. The collaboration of numerous colleagues, particularly with the provision of data, is also gratefully acknowledged. In particular, Carol Deliwe, Rian Cilliers, Ian Bunting, and Penny Vinjevold have provided critical data that are not otherwise easily accessible. Abt Associates, in particular Saul Johnson, provided the key demographic projections data. The commissioning of the paper was by Bobby Soobrayan and Pieter Morkel, whose role in motivating and guiding the paper is acknowledged. Errors and omissions in the paper are of course attributable only to the author.

3. Current teacher supply levels are very low by historical standards. Our analysis suggests that if supply is dwindling, it is not because individuals are acting irrationally, or because the incentives are quite poor, but because the demand is bureaucratically or budgetarily restricted, and individuals are reacting to the real probability of getting a job after exiting from teacher training under current conditions.

4. Forecasts of teacher demand and supply suggest a large and looming imbalance between supply and demand arising from the short term administrative measures taken to control enrolment in teacher training, and a collapse in willingness to enrol in training amongst potential teachers. These factors, coupled with demographic changes and the impact of HIV/AIDS, have created a situation where future demand is likely to be many times greater than current supply. This situation invites an urgent policy response

5. Our analysis suggests that addressing the HIV/AIDS-related imbalance in teacher supply and demand is possible, but very challenging. Some 30,000 new teachers per year would have to be trained. We offer some viable scenarios. Plans to insure efficient usage of capacity for teacher education would have to be developed. The cost would be very substantial, of the order of R3 billion per year at current training cost levels. Questions about the effectiveness of training programmes would need clear answers before committing such sums. Realistic decisions will have to be made about the support possible for HIV/AIDS orphans from formally trained and paid teachers. Any special arrangements for lower learner/educator ratios for orphans would increase annual demand for new teachers to 50,000 or more and escalate costs pro rata.

6. The HIV/AIDS epidemic is and will continue to be highly selective micro-regionally. Part of the planning response will need to allow flexible response by the system of human resource allocation to relative shortages at the local level. The current system is a mix of centralism (in its allocation of posts to schools and in its determination of the processes to be followed in assigning individuals to posts), and individualism and "participatoriness" on the other hand in the actual assignment of individuals. This approach has high transaction costs and may not be efficient or effective in a period of rapid and uneven changes in demand. New approaches would seem to be needed.

7. The systems for matching teacher supply and demand are facing a period of unprecedented turbulence. These seem likely to require more radical responses than those that were used to manage the system over the last five years. Our analysis suggests that the challenges are of a much greater magnitude than those of the recent past.

2. BACKGROUND AND INTRODUCTION

The teacher work force in South Africa has been undergoing turbulent change in the last few years as a result of a variety of factors. These include the merger of the old departments of education, the differing approaches adopted by Provincial governments to retrenchment and recruitment related to needs and financial resources, changes in the framework for teacher's qualifications, and the reorganisation of teacher education provision. The onset of the HIV/AIDS epidemic is now adding a new dimension to the turbulence experienced so far and has implications both for the supply and demand for teachers.

In order to put some parameters around past and future turbulence, this paper develops a systematic analysis of the main data sources available on teachers. We analysed the 1995, 1997, and 1999 October Household Surveys (OHS) and set up comparisons between teacher and non-teacher members of the working labour force across time. We took a cross-sectional cut of the entire PERSAL[2] database as it applied to employees of education departments in both November 1998 and November 1999 (exactly one year apart) in order to judge the dynamics of entry and exit into this database (and, hence, into the public teaching workforce) over a 1-year period. We undertook systemic demographic forward-modelling of the sector, based on the data from these sources as well as from administrative records. Finally, we analysed various other aspects of the data. We expected to be able to document great turbulence and critical trends. We expected to be able to make simple and portentous macro-level statements. What we found provides are range of insights which are worrying, but far too nuanced to result in statements that are portentous ***and*** simple.

[2] PERSAL is the central personnel database system for tracking certain characteristics of the employees of the state. It can be accessed centrally for analytical purposes, and locally for data entry.

3. THE DEMOGRAPHIC CHARACTERISTICS OF TEACHERS

South Africa is lucky, relative to other middle-income countries, in having a reasonably large, well-conducted, and recurrent set of household surveys that measure the socio-economic condition of the country. It may be fashionable at times, and in certain circles, to complain about StatsSA. But the reality is that the October Household Surveys, amongst other data series, are a useful source of information, sufficiently large to allow quite a lot of statistical power, and reasonably well carried out. We put together the 1995, 1997, and 1999 surveys and tried to glean what comparative data we could. There are limitations and dangers in doing this but we believe the risks are worthwhile.

An initial foray into the data produces the following results. Annex Table A1 summarises some of the results of statistical analysis. The conclusions below are stated with at least a 95% degree of confidence (though mostly with 99% confidence).

- **The teaching force is 20 to 25 percentage points more "feminine" than the rest of the working labour force and is becoming more so**. The entire working labour force became more "feminized" over the period 1995 to 1999. However, the teaching force did **not** become "feminized" at a faster or slower rate than the rest of the working labour force. There was no statistically significant difference between the rate of feminization of the teaching force and that of the whole working labour force. There is a generally declining preference for being a teacher; if anything, women's preference for being a teacher declined faster than men's, even though the teaching force became more feminine. In other words, women were increasingly taking up opportunities in non-teaching roles faster than in teaching, at the margin.

- **Teachers say they work fewer hours per week than the rest of the working labour force**. Self-reported data indicate teachers work some 17% fewer hours per week than those in the general labour force. Moreover, this does not take into account periods during the year when schools are closed – the data only refers to hours per week in an actual workweek. Furthermore, while the rest of the working labour force increased its rate of work over the period 1995 to 1997, the teaching labour force eased up its pace of work, in number of hours per week.[3]

- **Teachers report earning much higher income than other employed persons—some 64% more**. We should note that teachers are much more highly educated than workers as a whole and that this largely explains their higher income.

- Since the OHS measures income in nominal (inflation-uncorrected) terms, it is not possible to comment on whether salaries were changing in real terms without careful analysis of price inflation relative to wage inflation. However, it is valid to say that **average nominal salaries for the teaching force increased faster than for others in the workforce**.[4] (If real salaries in fact declined after

[3] Note that all this is by own declaration of the respondent.

[4] For the other population segments the sample size was too small to enable very firm conclusions. Also note that it is not of interest to judge whether average salaries were increasing in real terms for teachers, at least in the context of this analysis. It is possible to judge whether the rate of change was

adjustment for inflation, they declined less for teachers than for others in the labour force).

- **Teachers are far more educated than other employed workers**—they have some 56% more years of education on average. We cannot tell from OHS data whether the average years of education possessed by teachers increased over the period, either in absolute terms or in comparison with other workers.

- Given their lower rate of monthly work hours, **work-hour-adjusted salaries for teachers are even higher than nominal salaries, relative to other workers**. Work-hour-adjusted salaries also grew faster for teachers than for the rest of the working labour force.

- Teachers were more unionised than the rest of the working labour force at any given point, and while the working labour force as a whole became more unionised over the period, **teachers became unionised at a faster rate than the rest of the working labour force**.

- The average age in the working labour force declined, but **average teachers' age increased.**

- The most surprising factors are those relating to ethnicity or population segments. It appears that **white participation in the teaching labour force increased relative to participation in the working labour force as a whole, whilst that of Africans either decreased, or stayed constant in the teaching force but increased in the rest of the working labour force**. It is important to be clear what this data implies, since this is a surprising statement. The conditional probability of being a teacher is much higher if one is African than if one is white. But this conditional probability is decreasing for Africans and increasing for whites. A plausible hypothesis is that this is because the rest of the formal economy is opening up at a faster rate for Africans than are opportunities in teaching for Africans. It may be that opportunities for whites (relative to others) have waned in the rest of the formal economy faster than in teaching, either in reality or in terms of preferences by whites. Similarly, the conditional probability of being white, if one is a teacher, declined, whereas that of being African increased. But the conditional probability of being white, if one is in the rest of the labour force, decreased significantly faster than did the probability of being white if one is in the teaching labour force, whereas the probability of being African, if one is a teacher, increased more slowly than did the probability of being African if one is employed in the rest of the labour force. The trends observed may be due in part to the influence of teaching posts created by School Governing Bodies (SGBs) in public schools, or independent schools. The OHS is not restricted to teachers employed only by the public sector. Unfortunately, it does not contain information to allow comparisons between publicly and privately employed teachers.[5]

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higher for teachers than for non-teachers, but not whether it was higher or lower (for either teachers or non-teachers) than some index of price inflation.

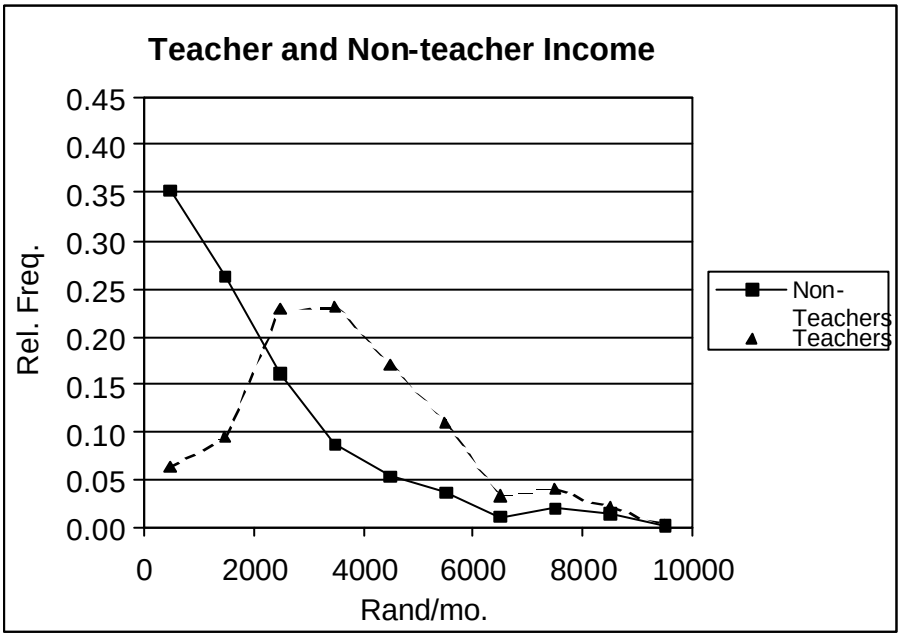
[5] This possibility was suggested by Kuben Naidoo.

4. INCOMES OF TEACHERS AND NON-TEACHERS

The data presented so far shows that teachers earn higher incomes than other employed workers. We will see that much of this higher income can be explained with reference to the higher levels of education required of teachers than of other workers. In this section we want to try to develop a sense of where teachers are in the overall income distribution: are most teachers better off than, say, the top one-quarter of the non-teaching workers, i.e., the rest of the labour force? Or better off than only, say, the top one-third?

Figure 1 presents the basic information. The relative frequencies of earning categories are shown on the y-axis, and the earning categories are shown on the x-axis.

Figure 1: Teacher and Non-teacher Income



The income distribution for non-teachers, for example, shows that about half of non-teachers earned less than about R2000 per month (about 36% were in the R0-999 category, and about 27% were in the R1000-1999 category), whereas about half of teachers earned more than about R4000. We should note that the OHS includes independent and probably some informal sector teachers, since it relies on the respondent's self-definition as a teacher. Thus, there are teachers earning surprisingly low salaries in the sample.

The greater the area under the teacher's curve is displaced to the right, compared to the area under the non-teacher's curve, the more that teachers are in the "elite" of income earners. Similarly, the smaller the y-axis value of the intersection between the two curves, the more that teachers are in an income elite relative to non-teachers (as long as the basic shape and positioning of the curves resemble those in the graphic).

Changes over time in income between teachers and non-teachers are illustrated in Table 1. This shows the value of the intersection points for teachers and non-teachers earnings, and the percentile for non-teachers whose earnings are the same as the 50th percentile for teachers.

Table 1: Income distribution characteristics for teachers and non-teachers

Year	Intersection of both distributions (y-axis value of the intersection)	Non-teachers below the teachers' 50th percentile
1995	0.217	80.1
1997	0.187	82.3
1999	0.172	84.3

Source: calculated by the author from OHS 1995, 1997 and 1999 data

The intersection simply shows the y-axis value at which the two curves intersect.[6] We can see that this intersection between the two curves displaced itself to the right (on the x-axis) or down (on the y-axis) between 1995 and 1999: the bulk of teachers were shifting away from the bulk of the population, in terms of income. The other indicator shows the percentile for non-teachers at the same income level that yields the 50th percentile for teachers. Thus, in 1995, for example, 80.1% of the employed population was worse off than the top 50% of teachers. In 1999, 84.3% of the population was worse off than the top 50% of teachers. Or, to put it another way, most (more than 50%) of teachers were better off than the top 15.7% of the working population. There was an increase of 4 percentage points in this indicator in the four years between 1995 and 1999. Teachers were increasingly in the economic elite amongst the employed.[7] If we were to add the unemployed, we would see that teachers are indeed at the very top of the income distribution. Note that both measures drifted from each other by about 4 percentage points or 0.04 in absolute terms.[8]

One further point is of interest in relation to teachers' incomes. We have noted that in general teachers earn much higher incomes than other employed workers. However, they are far more educated and vary in other ways. For example, they are more female, more African, and more unionised than other workers. The question arises: do teachers have an advantage, or a disadvantage, over other employed workers in the labour force, if one considers the fact that their demographic and education profile differs from that of non-teachers. Some insight into this question can be obtained from Figure 2. This shows the pay advantage (average teachers income – non-teachers income) in 1999 by REQV level and age. The example chosen is for African female teachers, this being the most common category of teacher. The underlying analysis, which creates this chart, is described in detail in the original monograph.

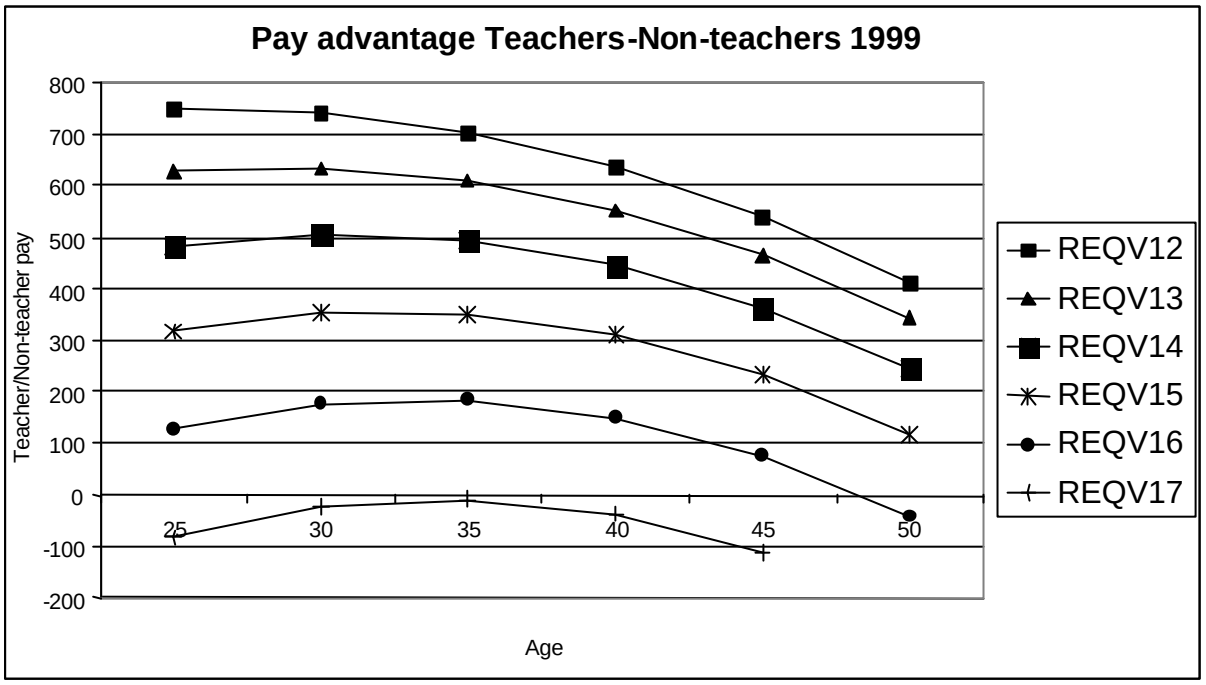
[6] This was estimated by looking at income groups on the x-axis, and the relative frequency of incomes on the y-axis. The intersection was determined by solving for both x and y in the two implicit equations for the straight line segments that intersected.

[7] There is no statistical hypothesis test that leaps to mind for ascertaining whether these trends are statistically significant. However, if we simply note that the standard error for the proportion of the population falling in, say, the 3rd income group above is about 0.006, it would appear that we can be confident at the 95% level of there being a real trend here. Since we have seen above that the average earnings of teachers did increase faster than those of non-teachers, the two results are consistent, and we can be more confident of what we are saying.

[8] This is logical, given that the two measures approach basically the same idea but in different ways. The first column shows the y-axis value of the intersection, whereas the second column shows the left-side area under the non-teacher's curve at the point where the left-side area under the teacher's curve covers 50% of the total area under the teacher's curve.

Figure 2 shows that for almost all REQV categories of teachers there is a positive pay advantage, which diminishes with age. Teachers earn more, controlling for their education level, than do other workers. Only at the highest levels does the pay advantage become negative – i.e. being a teacher provides less income than other occupations to those with the highest qualifications. We can note that pay advantages are greatest for the least educated and the youngest. Other things being equal this should mean that the incentive to become and remain a teacher is highest for these groups.

Figure 2: Pay advantage Teachers – Non-teachers 1999



In conclusion, at a macro level (though not, obviously, in the individual classroom) most teachers are better off than the parents of all but about the wealthiest 10% to 15% or so of the children they teach. It is impossible to portray teachers as belonging, as a mass, to the same socio-economic class as the parents of the children they teach, again as a mass. And the gap seems to have increased between 1995 and 1999. We can note that as countries develop, the normal trend is for teachers to start out being a relatively privileged class in society and then evolve towards being approximately in the same income/social class as most parents. South Africa's teachers are more distant from the income base of parents than is normal in other countries at the same level of economic development. Furthermore, South Africa seems to be moving further away from the norm of other countries. As South Africa develops the deviation in income between teachers' and that of the majority of parents is widening. At this point in time any identification of teachers as being in the same socio-economic group as most parents seems to have more to do with emotional and political issues, than with economic realities. If current trends continue the distance between teachers and parents in terms of average incomes will become even greater.

5. TEACHER TURNOVER – THE DYNAMICS OF TEACHING EMPLOYMENT

The PERSAL data allow a much more fine-grained examination of the dynamics of the teaching force. Unfortunately, unlike the OHS data, they do not allow for direct comparisons between the (public) teaching force and the rest of the (public and private) working labour force.

Perhaps the system has indeed stabilised as of 1998, and there was much more turbulence between, say, 1996 and 1998 than between 1998 and 1999, the only period we can ascertain with the PERSAL data at hand. In any case, the picture that emerges from a comparison of the numbers and characteristics of those disappearing from the database between 1998 and 1999 and those appearing in it, hardly suggests a system in turmoil, at least at the macro, national level.

Table 2 shows the leaving and joining rates, plus the sum of the two as an index of turnover (e.g., 2.6% + 0.7% = 3.3%) by province. Note that the national level is not very high, but there is enormous variance between provinces.[9]

The wealthiest and traditionally best-endowed provinces (Western Cape, Northern Cape, and Gauteng) underwent considerable turnover, whereas in the poorest provinces the turnover was lower. There is a net loss from the sector (e.g. 5.3% - 1.9% = 3.4%). The numbers for net loss follow no clearly discernible patterns.

The PERSAL data confirm the OHS results that the teaching force is not just female-dominated, but increasingly so.[10] More men than women left, and more women than men joined. And, the proportion of women joining is larger than the proportion of women in the database. Annex Table A2 shows the basic demographic characteristics of those who were in the database in 1998, those who apparently left it, and those who joined it.

[9] South Africans may find these rates high. Indeed, some early readers of this document commented on how high these rates seemed. But, as the following quotes from the USA and Canada show, South Africa's rates of turnover, at least during this period, are low, or at worst on par with some other countries: (1) "Nationally, it is estimated that 30 percent of new teachers leave during their first two years, and more than 40 percent depart during their first four years. Studies also show that teachers who leave the profession reported a lower mean income than those who stayed, challenging the belief that teachers quit to earn more money in other careers." (Mentoring and Leadership Resource Network, mentors.net/LibraryFiles/OutaHere.html). Notesimilarity of these rates for young teachers between these U.S.-wide numbers and those of South Africa. (2) "On a Canada-wide basis, 21.7% of teaching staff had left their jobs in the previous 12 months. Of those who left, 38.1% quit voluntarily, 13.3% were fired for poor performance, 11.5% were laid off for reasons such as decreased enrollment or their time-limited contract period ended, and 11.0% took a leave of absence. The remaining 26.1% of staff who left did so for a variety of un-stated reasons." (Child and Family Canada Website, http://www.cfc-efc.ca/docs/00001054.htm).

[10] With PERSAL we are dealing with administrative records where the sample therefore equals the universe, all of our statements have been assessed for statistical significance, and we discuss only results that are valid with at least a 95% confidence interval.

Table 2: Turnover characteristics of various provinces and national level between 1998 and 1999

Turnover characteristics of various provinces and national level between 1998 and1999				
	Leaving	**Joining**	**Turnover ratio**	**Net change**
EC	2.6%	0.7%	3.3%	-1.9%
FS	6.5%	1.4%	7.9%	-5.0%
GT	8.6%	3.9%	12.5%	-4.6%
KN	6.3%	0.8%	7.1%	-5.6%
MP	3.5%	3.3%	6.7%	-0.2%
NC	6.8%	3.2%	10.0%	-3.6%
NP	6.0%	1.4%	7.4%	-4.6%
NW	2.8%	0.8%	3.6%	-2.0%
WC	5.8%	5.5%	11.3%	-0.3%
National	5.3%	1.9%	7.3%	-3.4%

Source: calculated by the author from PERSAL database.

Notes. 1. Numbers do not always add up perfectly due to rounding error. 2. The turnover ratio used above is not the standard human resources turnover ratio. We use the sum of the "leaving" ratio and the "joining" ratios, whereas the standard measure is the "leaving" ratio. Given the low correlation between the "leaving" and "joining" ratios in this case, we felt that the sum is more indicative of total movement.

The data by population group are interesting but also puzzling. This data contradicts the OHS data, which suggested that about 20% of all teachers were white, as recently as 1999. However, the PERSAL database suggests that only some 12% of teachers are white. It is quite possible that this is largely due to teachers being employed by school governing bodies (SGBs) and by independent schools. It would require that there be some 30000 white teachers employed by independent schools, SGBs, or in informal situations.

Aside from this issue it is clear that Africans are leaving ***and*** joining the teaching force in smaller proportions than their proportion of the teaching force. While some 76% of teachers are African, 61% of those leaving are African, and 64% of those joining are African. In contrast, while some 12% of teachers are white, about 28% of those leaving are white, but, interestingly, some 20% of those joining are also white. This evidently deserves some further examination. It is possible that there is a sort of "churning" of white teachers out of and back into the teaching force. The dynamics for coloured teachers were the most extreme, in that they are joining at rates much greater than their proportion of the teaching force.

Despite these levels of turnover and turbulence, an examination of the PERSAL data shows remarkable predictability in the age distribution of both those joining the database and those leaving it. Figures 3 to 6 illustrate the issues quite aptly. Note that for each dimension concept (age and REQV) there are two graphs: the leaving and joining rates, and the distribution of leavers and joiners. The former gives one a sense of how the "average" teacher of a given age or REQV is reacting and behaving, whereas the latter gives a sense of how that behaviour translates into numbers leaving and joining. For example, we see below that teachers with REQV 14 were leaving at a faster rate than were teachers with REQV 13, as a proportion of the total number of

REQV 14 teachers. But, because there are more teachers with REQV 13, the total number of teachers with REQV 13 who were leaving was higher than that of teachers with REQV 14 who were leaving.

Figure 3: Leaving and joining rates by REQV 1998, 1999

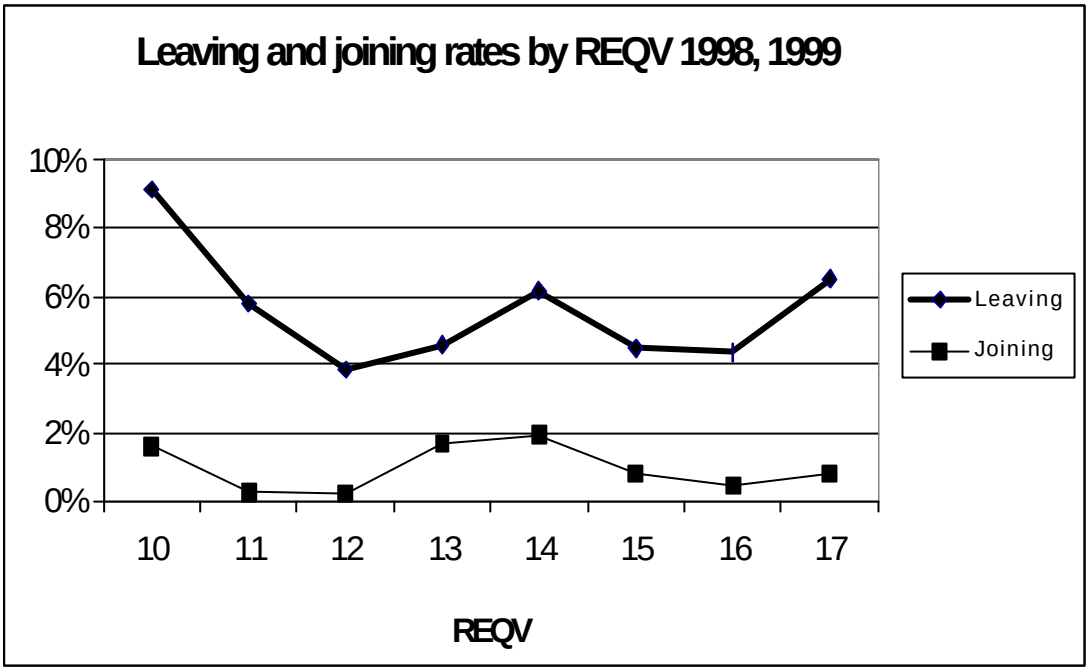


Figure 4: REQV distribution of leavers and joiners 1998, 1999

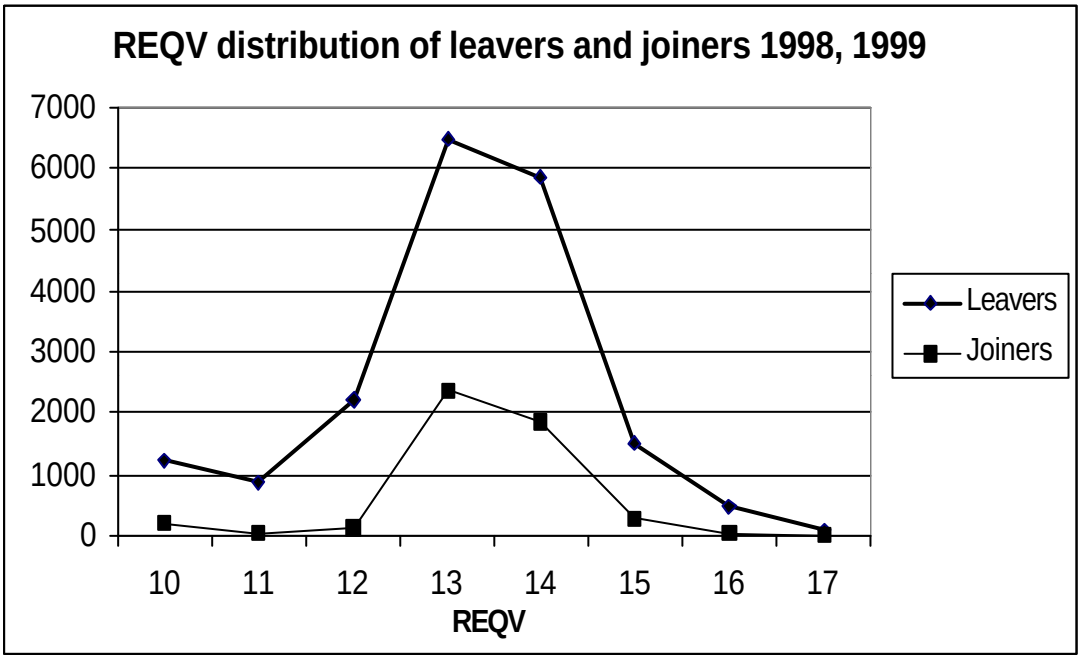


Figure 5: Leaving and joining rates by age, 1998 and 1999

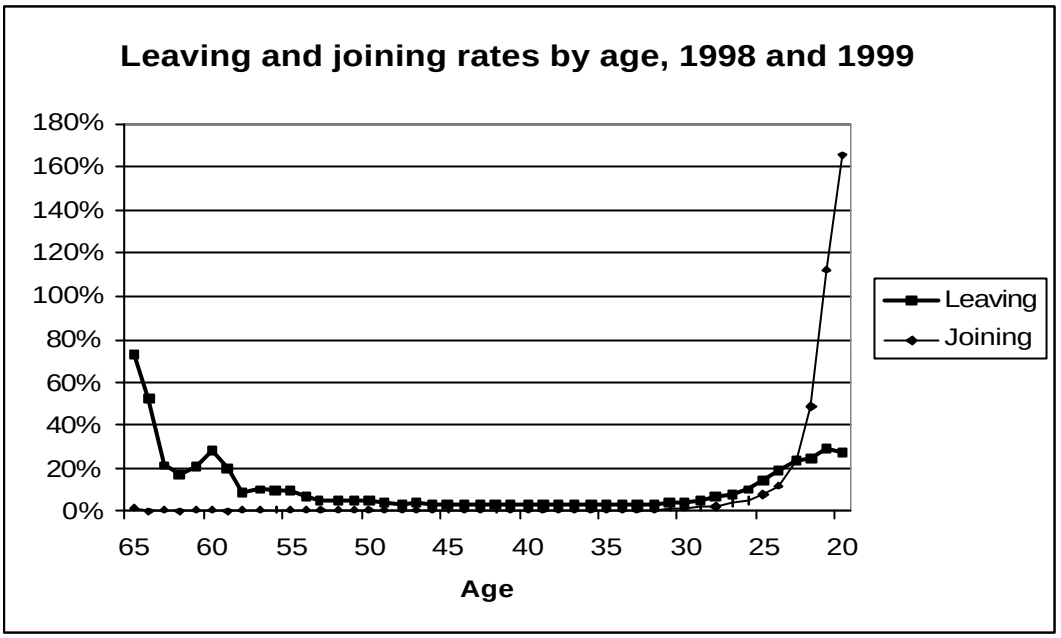
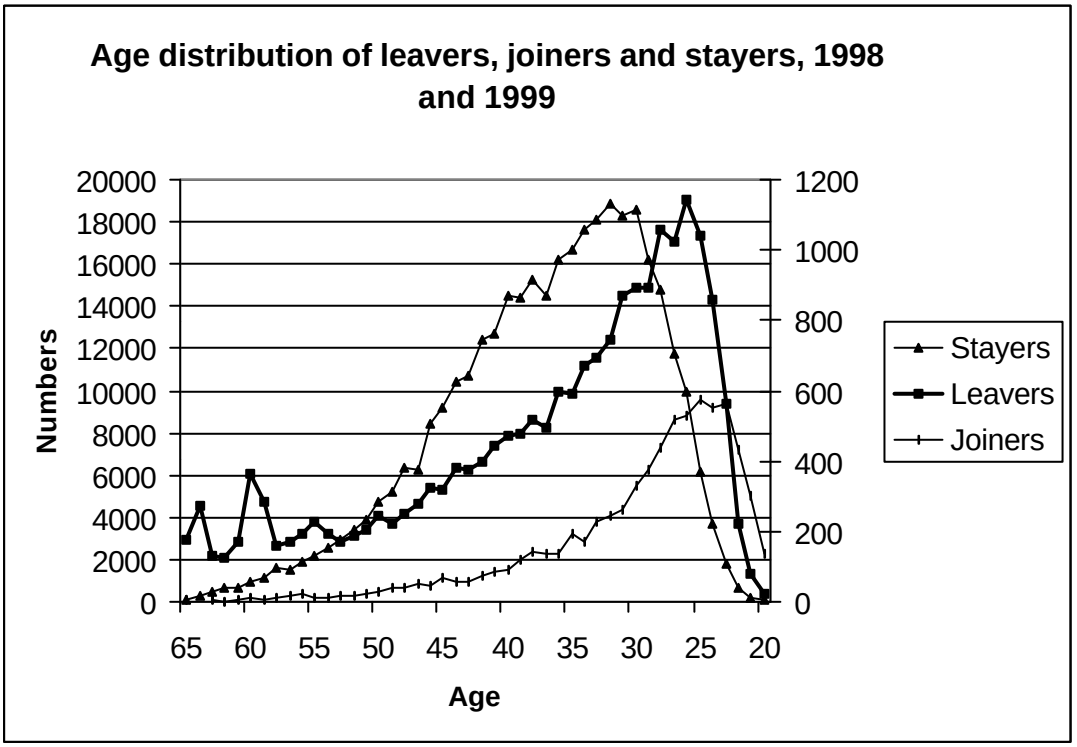


Figure 6: Age distribution of leavers, joiners and stayers, 1998 and 1999



The rate of leaving (those leaving divided by those in the database) by REQV is what one would expect and corresponds to policy: those with the least education are leaving at the fastest rate. There are two other peaks: at REQV 14 and REQV 17. Interestingly, the pattern for the joining rate reflects the pattern for the leaving rate but naturally at a lower level, given that there was net outflow from the database.

If we look at the REQV distribution of the numbers (not rates) of leavers and joiners, we note a much clearer peak at REQV 13. Again, however, the REQV distribution of those leaving and those joining is extremely similar, suggesting stability in the system. In terms of the tabular analysis, the REQV data are also of some interest. The composition of those joining is much more tightly concentrated around REQVs 13 and 14 than the composition of the base (i.e., 46.1% and 36.1% of the joiners are at REQV 13 and 14, as opposed to 38.6% and 25.8% for the base). This suggests that the teaching force is becoming less diverse in terms of training.

The age distribution of leavers and joiners also suggests stability and order, though with some surprises. Above all, these figures suggest that the notion of teachers leaving the profession during their (presumably most productive) middle-level years is either mythical or is no longer the case. The pattern of leaving suggests that those who leave are mostly either ready for retirement (note the peaks at exactly 65 and 60) or are very young and therefore simply giving the profession a try or joining while awaiting better prospects, and leaving quickly upon finding them. Note that in terms of the age distribution, the peaks for leaving are 65 and 21; for joining, around 20; and for those who stay, 32. Note how closely the distributions for joining and for leaving resemble each other, except for the old-age peak in the latter. Note that the average age of teachers is about 37.

What is very interesting about both the age and REQV data is that the leavers and joiners are more like each other than they are like those who stay or who were in the database to begin with. For example, those who leave ***and*** those who join tend to be more concentrated around REQVs 13 and 14 than those who were in the teaching force at the start. Similarly, those who join and those who leave tend to be very young. The fact that joiners are young is expected. However it might be thought surprising that the young would leave at such fast rates, and that so many of the leavers would be young.

Figures 7 and 8 combine the REQV and age data. Because there are insufficient data points in each combination of REQV and single-year age groups, we utilised 5-year age groups. This is why the data appear smoother, from the x-axis point of view, in the following graphic than in those preceding. Points containing less than 25 leavers have been excluded from the graphic, as a simple statistical-validity precaution. That is why there is no curve for REQV17, and it is also why some points are missing from some of the other curves, though this is not easily visible to the naked eye. Note that the two graphics present exactly the same information, but from two different perspectives.

It is clear that teachers with different REQVS respond in extremely similar ways to the pressures (or opportunities) for leaving the profession, with the possible exception of the low leaving rate for REQV12 at the younger end of the age spectrum.

It is also clear that the bulge in those who leave at REQV 14 is concentrated amongst young teachers (the 20 and 25 age groups). Otherwise, in other age groups, leavers are concentrated amongst the less-educated teachers. This is not surprising, since it is the younger and least educated teachers who seem to have enjoyed the best pay advantage (or least disadvantage) in the mid 1990s.

Figure 7: Leaving rates by age and REQV, 1998

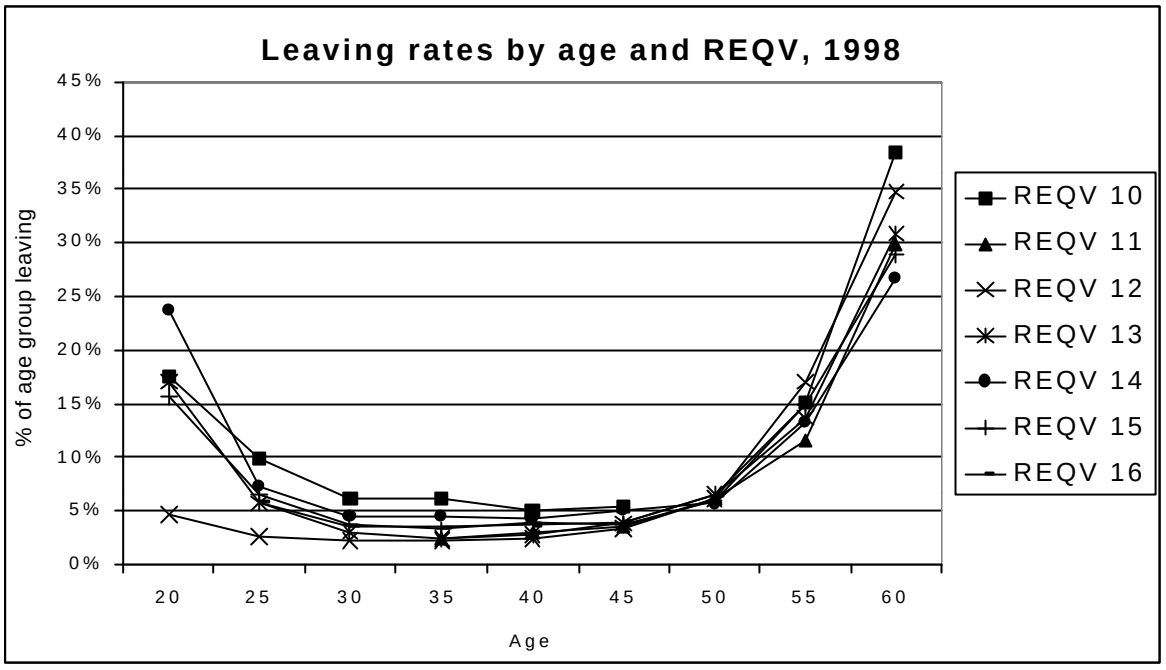
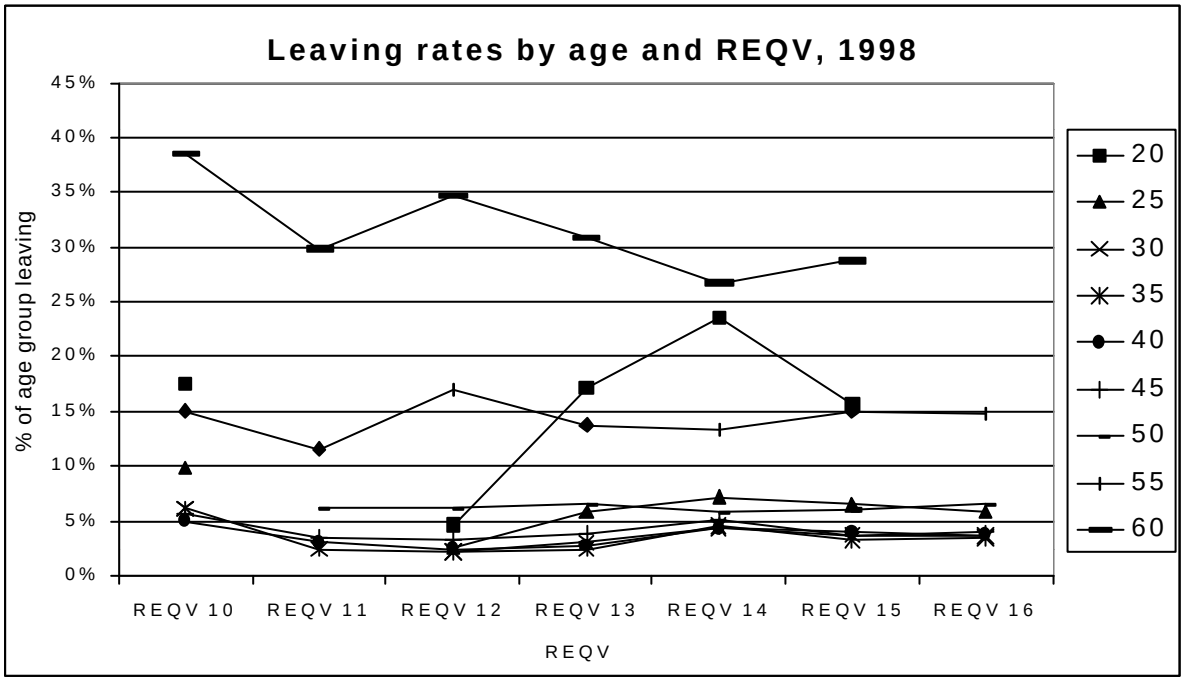


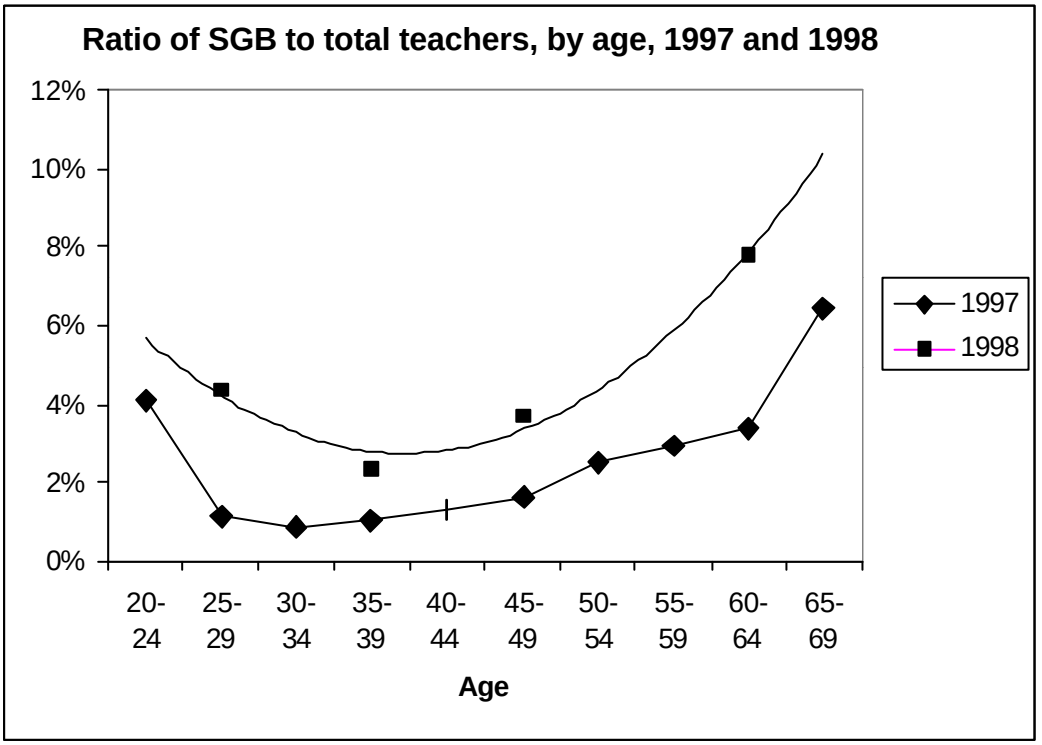
Figure 8: Leaving rates by age and REQV, 1998



Having a pay advantage, as noted previously, would explain the high joining rates for younger and less-educated teachers. This high joining rate for the young is also probably explained by the simple fact that, once a young person is trained as a teacher, a fairly logical first step in the job market is a job as a teacher. However, young teachers also *leave* in high numbers. One explanation might be that once they have been teaching for a year or two, they begin to understand what their lifetime prospects are and that their relative pay advantage is likely to decline; the more highly educated, the more they leave, because the more their lifetime earning prospects appear poor relative to the rest of the labour force. We can see that there are three groups who really represent very high leaving rates: the best-educated young and then the old in general. But note that amongst the young, the best-educated have higher leaving rates, and among the old, the least educated have the higher leaving rates.

One destination for the leavers is, perhaps, employment with school governing bodies. Figure 9 shows how neatly the ratio of school governing body (SGB) employed teachers matches the rate of leaving from the PERSAL (public) database. Also note that the differences in the ratio of SGB to total teachers by age is statistically highly significant: middle-aged teachers are much less likely to be teaching in SGB posts than are the young and the old. Unfortunately, we did not have at our disposal similar data for independent school teachers.[11]

Figure 9: Ratio of SGB to total teachers, by age, 1997 and 1998



[11] Note that for 1998 we did not have as many data points as for 1997, so we display a fitted curve through the 1998 data points, whereas the line through the 1997 data points is not a fitted line.

6. FORECASTING BASIC NUMBERS

In this section we attempt a little crystal-ball gazing to forecast the basic supply and demand for teachers. Forecasting something so susceptible to social trends and policy shifts as teacher supply and demand is extremely hazardous. These sorts of forecasts have no rigorous confidence intervals; we cannot state our confidence in the results in the form that we are 95% certain that the forecast for the year *t* lies in the interval [*x*,*y*]. The demand side is relatively easy to forecast, but the supply side (and therefore the gap between supply and demand) is really quite chancy. All we can say is that these are not true forecasts, but simply conditional projections; that is, projections conditional on a whole host of assumptions, some of which have to do with likely demographic changes (including those related to HIV/AIDS), and some of which have to do with possible policy choices in the future.

The forecasts we offer are likely to be more reliable if we regard them as "broad brush" and medium- to longer-term in character and not short-term. For technical reasons beyond the scope of this report, projections are often particularly unreliable in the first few years. In the longer term, powerful determinants, such as basic demographics, whose parameters are more solid, tend to exert more influence than short-term phenomena such as teacher training or promotion policy.

Any forecasting depends on lists of assumptions which can be used to define different future scenarios. The process of systematically identifying assumptions itself helps gain insight into the likely behaviour of the main parameters which will affect teacher supply and demand. It also helps identify levels of confidence in assumptions and bands of uncertainty which can frame a range of projections to guide policy, rather than fruitlessly searching for a single "best" projection.

Annex Table A3 summarises the range of assumptions made in forecasting. Table 3 summarises the results in terms of likely gaps between supply and demand for different scenarios. If the gap is positive, this means that demand is greater than supply: there is a shortage. If the gap is negative, it means supply is greater than demand: there is a surplus.

Table 3: Conditional forecasts of gap between demand and supply

Scenario	Explanation of scenario	Yearly gap 2001-2005	Yearly gap 2006-2010	Yearly gap 2011-2015	Demand (needed production) in mid-decade
1	Recent policy framework assuming declining enrolment due to early decline of population due to fertility transition, tightening of age controls, etc., and cutback in teacher training programmes, but no radical reaction by students choosing not to enrol in teacher training programmes. Assumed no HIV/AIDS impact known.	4000	-4000	-2000	11000
2	Same as scenario 1, but students react by radically choosing not to enrol, in response to lack of jobs due to relative hiring freezes in mid- and late-1990s; assumes that such a reaction is permanent. Assumed no HIV/AIDS impact known.	7000	3000	7000	11000
3	Assumes slower fertility transition (so no early population decline due to this factor), but worst-case HIV/AIDS scenario. No special attention to HIV/AIDS orphans via standard teacher training and supply. Assumes student over-reaction as in scenario 2.	13000	17000	21000	25000
4	Same as 3, but students' choice of teacher training as a post-secondary option goes back up to nearly historic levels. Requires clear hiring messages from authorities, as well as low-cost study options for those choosing to be trained as teachers.	8000	2000	1000	25000
5	Similar to 3, but, on top, it is assumed HIV/AIDS orphans require special attention (L:E ratio of 10 to 1 for orphans). In addition it is assumed that student over-reaction is reduced by ½.	29000	38000	48000	57000
6	Similar to 5, but assumes that students' choice of teaching as a post-secondary training option goes back up to the level of the early 1990s, or five times (400%) the current level	28000	20000	12000	57000

Source: calculated by the author.

Scenario 1 shows what would have happened had the policy assumptions on which the planning was based in the early 1990s turned out to be true. It indicates that the planning projections were fairly accurate given what was known at the time. It shows a small over-supply developing in the medium term after 2000. Considering that the teacher employment base is some 350,000, an apparent over supply of a few thousand is an acceptable result. An important assumption is that cutbacks in enrolment come faster than any increases in the graduation rate from programmes, or in the proportion of students who actually join the teaching profession. The small over supply appears

later as demographic changes work through. Scenario 1 needs modifying in the light of what is now known about changes in key parameters.

Scenario 2 illustrates what seems to have happened as students reacted to poor prospects due to hiring freezes and general teacher labour market conditions in the mid 1990s. If students react to the poor hiring prospects and the closing of teacher training colleges by assuming that job prospects will be as bleak as they were in the late 1990s indefinitely, then recruitment will fall. Historically (in the early to mid 1990s), about 15% of matriculants chose to study teaching. By 2001 at best between 3 to 5% are choosing to enrol in teacher education. Even if an improvement in the graduation rate is assumed, and there is an improvement in the proportion of graduates who become teachers, there is a shortage starting now, which continues. However, the shortage is not as severe as one might think, because population growth is down, and enrolment in grade 1 is less bloated than previously.

Scenario 3 shows what may happen as HIV/AIDS affects the country's teacher supply dramatically and students' low propensity to enrol in teacher education continues. Very large yearly deficits in supply show up very early. Cumulative yearly gaps as high as 20,000 teachers show up by 2010.

In scenario 4 we assume that students recognise that hiring will not be permanently frozen. It is assumed that authorities send clear messages that hiring will resume (partly as a result of attrition related to HIV/AIDS). Possible changes in policy could also shorten the length of training or ease entry requirements. Eventually the shortage is addressed. But note that it might take some time to change student behavioural choices. If the messages are clear and strong, then the shortage could be addressed more quickly, instead of having to wait until 2006 or so. The scenario assumes only a very slow reaction by students.

Scenario 5 assumes that HIV/AIDS orphans require special attention, and that student propensity to enrol in teacher education doubles. That is, it is assumed that student choice of teaching as a post-secondary option is improved by 100%. A learner:educator ratio of 10:1 for HIV/AIDS orphans was used to generate this scenario. The costs of responding to special needs of HIV/AIDS orphans are immense. In this case a yearly shortage of some 38,000 and subsequently 48,000 teachers develops.

Scenario 6 is the same as scenario 5, but assumes student perceptions of teaching as a career improve dramatically and result in applications five times current levels. Despite this there is a yearly shortage of 12,000. This scenario is fairly important. It suggests that even in the extremely unlikely scenario that students go back to choosing teaching in the same proportions they did in the early 1990s, there would still be a very large shortage which is most acute in the near term.

In conclusion to this section, we believe the following cautious statements are justifiable.

- If the state attempts to pay special attention to the orphanhood generated by HIV/AIDS, and attempts to do so with formally trained teachers, then we simply do not see any scenarios that make this feasible, unless educational resources were

to be heavily skewed towards this one task, and many other educational tasks dropped or minimised.

- If the state decides not to pay special attention to orphans, or admits that it simply cannot do so with formally trained and paid teachers, then it is possible to think of scenarios wherein the system could train sufficient numbers of teachers to cope with HIV/AIDS amongst teachers, and then address the issue of orphanhood through more informal and community-based means. Essentially, "all" that would be required is a return to the basic social parameters of transition between Grade 12 and teacher training that were common in the early 1990s. One would have to plan so that some 15% or so of matriculants would choose to become teachers, instead of the 2%–3% that are making this choice now. Our research suggests that this requires not so much a shift in pay policy or salary scales, as for the state to start sending out clear messages to secondary school students about the likelihood of jobs being available in teaching and improved planning and expanded enrolment capacity in cost-effective teacher education.

- The latter would require considerable analysis of options for the cost-effective training of teachers which is beyond the scope of this paper. It may suggest that teachers should not be trained through the relatively expensive, and perhaps relatively inefficient, methods common in the early 1990s and certainly common in the late 1990s. We calculate, for example, that the social cash cost (i.e., public and private, but without counting the private opportunity cost) of one year of pre-service training, by the late 1990s, was approximately R45,000 to R50,000 per student per year in teacher training colleges, and approximately R20,000 per student per year at higher education institutions. However, we note by the late 1990s, teacher training colleges were running well below capacity. When they were functioning at levels closer to capacity the cost would have been less.

- The issue of the real effectiveness of the training has to be faced. While some South African research suggests that pre-service teacher training is an effective form of expenditure by the state, it is unclear whether it is the subject-matter content of the training, or other aspects of the training are most efficacious. There is a risk that much training in the past may have been a form of screening for the profession with a limited amount of value added, or worse from a public investment point of view, might simply have been a stepping stone to other careers.

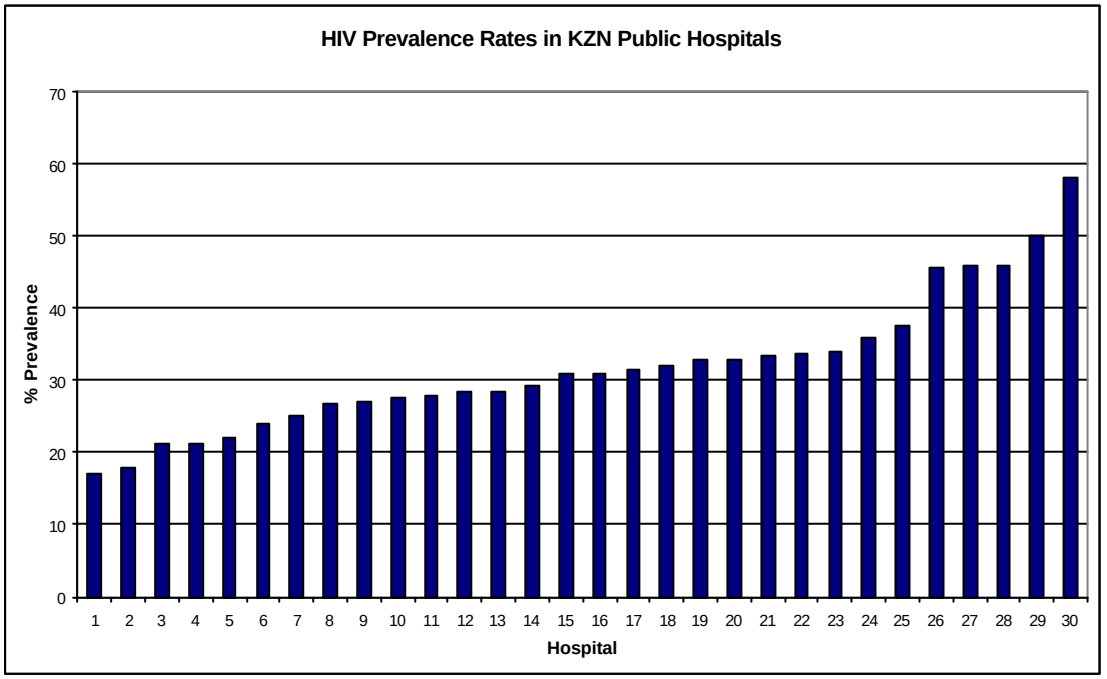
- Three to four years of pre-service training is likely to cost R60,000 R100,000 per teacher. Scenario 4 above, which is what is needed to reach some form of balance, suggests training some 30,000 new teachers per year. At a cost of R80,000 per teacher (to take the mid-range), the price tag is about R2.5 to R3 billion per year. Such an expenditure must be cost-effective. Before embarking on the sort of scale-up suggested above and in Scenario 4 as a way of coping with the effects of HIV/AIDS, we would suggest that this matter be addressed as a matter of utmost urgency.

7. REGIONALITY AND MICRO-REGIONALITY OF THE HIV/AIDS EPIDEMIC

A final set of observations concern a simple but important point: that the HIV/AIDS epidemic strikes in a highly selective manner. This implies that the administrative measures used to confront the epidemic will need to be localised or, alternatively, much more directive.

Figure 10 shows HIV prevalence rates at 30% in KwaZulu Natal hospitals in 1998. The hospitals' names have been omitted to protect anonymity and to draw attention to the numbers themselves rather than to the hospitals. A certain degree of homogeneity has been ensured by focusing on Provincially managed hospitals, excluding clinics, private hospitals, etc.

Figure 10: HIV Prevalence Rates in KZN Public Hospitals



Source: Personal communication, Daniel Wilson, EduAction, Durban. Original data: Medical Research Council, Dept of Health

These prevalence rates may or may not reflect likely prevalence rates amongst teachers. However, the age groups at which these prevalence rates apply, and the gender to which they apply, are actually fairly coincident with the demographics of the teaching force. But let us be conservative, let us use these numbers to help us reason in terms of schools, and let us assume that the variability (not necessarily the mean) of HIV-prevalence rates at the hospitals bears some reasonable relation to the variability in eventual HIV/AIDS-incidence rates in regions but a little lower. It seems safe to assume that in some schools 1 teacher out of 10 will be affected by

HIV/AIDS, and will likely die, whereas in other schools, 4 out of 10 teachers will be affected and will likely die.[12]

It is unreasonable to suppose that any system of human resources allocation that is centralised (in actual resource allocation using a provincially driven post allocation model) and yet participatory (in consulting many stakeholders for every transaction) will be able to cope with this problem. The problems of *participatory* coordination, but from a *centralised* resource allocation will simply overwhelm the administrative capacity of the system. It would seem that the human resources provisioning system will have to be either far more directive and non-participatory (the locus of allocation matching the locus of deployment decision-making, and transactions costs being lowered) than it is now, ***or*** far more decentralised (again, the locus of allocation now being made coincident with the locus of deployment decisions). The present mix is quite attractive in some ways, but it can work only in a highly stable and predictable environment where its high transaction costs can be ignored.

One may be tempted to take comfort in the notion that these wide micro-regional or regional differences are to be expected only in a country in the early stages of the epidemic. Data from countries with mature epidemics, however, suggest (only suggest) that the problem gets, if anything, worse as the epidemic matures. The following data (Table 4) from Uganda illustrate the point.

Table 4: Regionality of HIV prevalence in a mature epidemic, Uganda 1998

	Prevalence rate
Two lowest regions	
Matany	1.3
Pallisa	2.6
Two middle regions	
Mbale	6.3
Soroti	7.7
Two highest regions	
Kagadi	11.5
Mbara	10.9

Source: UNAIDS/WHO Epidemiological Fact Sheet, 2000 Update, http://www.unaids.org/hivaidsinfo/statistics/june00/fact_sheets/pdfs/uganda.pdf

As can be noted, the ratio of highest to lowest prevalence rates is about 5 to 1, thus, in fact, higher than that in South Africa. Countries other than Uganda show exactly the same pattern, but we are not showing the data so as not to clutter the presentation. However, note that the absolute magnitude of the prevalence rates is lower in Uganda than in KwaZulu Natal (admittedly perhaps the worst-affected overall region in South Africa). The administrative nightmare of dealing with a high variance really only shows up if the averages are also high, which is the case in KwaZulu Natal and in other badly affected regions of South Africa.

[12] Note that this does not mean that the death rates at those schools in any given year will be 10% and 40% respectively. All other things being equal, if the disease lasts, say, seven years from infection to death, a prevalence rate of 50% would be approximately equivalent to a death rate of 7% (50/7). To see why, note that the prevalence of death amongst humans is 100% (we will all die sooner or later), but it takes us about 65 years to die, on average, so the death rate at any moment is about 100/65 or 1.5%.

8. CONCLUDING REMARKS

The most important over-arching point is that our conclusions are highly tentative, in particular in reference to teacher supply. The in-depth sociological and economic analyses of teacher identity, occupational choice, and the dynamics of the teacher labour market in South Africa, which would be needed to underpin a serious policy and planning position on these matters, simply have not been done. We are offering a first approximation review of extremely complex issues. We challenge our colleagues and the education establishment in South Africa to undertake the necessary studies. In particular, we call for an extensive random sample survey of teachers and case-controls in the labour market and society at large, combined with a qualitative analysis; a study that takes the individual and collective voice of teachers seriously enough to honour it with the best research possible. We feel that the choices young people make, in terms of choosing or not choosing the teaching occupation, are simply not sufficiently understood, and that unless this understanding is improved many-fold, policy and planning mistakes are very likely.

The main findings from the analysis that underpins this chapter were stated in the initial overview. They present a picture of the teaching labour force that is partly at odds with some current policy related rhetoric. They highlight a number of important issues that must be configured into debate over future policy on teacher education.

To inform current debate we note that:

1. Teachers differ from the South African labour force in a number of important ways. Significantly, their earnings are generally well above the mean, and their reported working hours are less than other groups. From the data there is no macro level evidence that teaching is an unattractive occupation as a result of pay levels.

2. Teacher turnover since 1995 has not been high and follows fairly predictable characteristics. Most who join and leave are young. Those who establish themselves in teaching as a career tend to stay. This is consistent with income data that indicates that most, except the most well qualified, enjoy an income advantage over similarly qualified individuals in other occupations.

3. The current supply of teachers appears to be well below that which is likely to be needed to meet normal demand arising from demographic factors. The likely effects of HIV/AIDS will create very considerable additional demand. For this to be met several things need to change.

First the propensity for young people to choose a teaching career and enter training has to increase substantially. There has been an (over) reaction to hiring freezes which has undermined demand from students.

Second, training capacity has been radically reduced from the (over) generous levels provided in 1994. It appears necessary to consider a new expansion. If the need is confirmed, consideration has to be given to cost effective modes of initial training which may differ from those historically in place.

Third, HIV/AIDS will rewrite the teacher supply and demand equations on current projections. The implications are as yet poorly understood but evidently very extensive. New systems of training and deployment are likely to be needed to meet this challenge.

ANNEX

Table A1 shows in summary form all of the "multivariate" relationships which we have used to double-check more rigorously, and either confirm or deny, trends and differences. This is presented without showing the actual numbers, both to save space and because the numbers individually are not very important. The symbols below should be read as follows: A + implies a positive relationship, so that, for example, being a teacher implies a higher salary. A *** implies that the relationship is statistically significant at the $1/10^{th}$ of 1% level (an extremely high level of significance), ** at the 1% level, and * at the 5% level. We do not report relationships significant only at the 10% level. NS means that the relationship is "statistically not significant" (that is, more precisely, that the hypothesis that there is no relationship cannot be rejected with a reasonable level of certainty). Thus, for example, the symbols -,*** and -,*** in the columns for "Interaction of time trend and teacher dummy variable" and "Simple time trend for teachers only" and the row for "Hours worked" mean that, assuming the surveys are constructed properly, hours worked per week decreased for teachers and increased for other workers; in other words, there is only a 1 per 1000 chance that we would have measured these relationships as strongly as we did were they not true.

Table A1. "Multivariate" analysis of simple demographic trends, using sampling weights

Equations where the dependent variable is either a quantity (e.g., salary) or the conditional probability of being in a group				
Dependent variable	(1) Dummy variable for being a teacher	(2) Simple time trend	(3) Interaction of time trend and teacher dummy variable	(4) Simple time trend for teachers only
Salary	+,***	+,***	+,***	Irrelevant
Salary, controlling for hours worked	+,***	+,***	+,***	Irrelevant
Probability of being African	+,***	+,***	-,***	NS
Probability of being coloured	-,***	+,***	NS	NS
Probability of being Indian	NS	NS	NS	NS
Probability of being white	-,***	-,***	+,***	NS
Probability of being female	+,***	+,***	NS	+,***
Probability of being a union member	+,***	+,*	+,***	+,***
Age	-,***	-,***	+,***	+,***
Hours worked	-,***	+,***	-,***	-,***
Equations where the dependent variable is the conditional probability of being a teacher, as determined by a particular variable				
Condition or group	Dummy for the condition or group	Simple time trend	Interaction of time trend and dummy for the condition or group	
Union membership	+,***	-,***	+,***	
Female	+,***	-,***	-,*	
African	+,***	NS	-,***	
Coloured	-,***	-,***	NS	
Indian	NS	-,***	NS	
White	-,***	-,***	+,***	

Source: OHS 1995, 1997, and 1999. Author's tabulation.

Notes: 1) The fourth column in the first panel above arises out of a different equation, in each case, from that in the first three columns. In the fourth column the non-teachers have been filtered from the database and a simple time trend is fit for the relevant quantity or conditional probability. It has to be done this way because the single equation implicit in the first three columns would be over-determined if the database had been filtered for non-teachers. 2) The simple time trends for salaries for teachers only (fourth column) are irrelevant because the salary data are in nominal terms. Thus, in these two rows only the comparisons between teachers and non-teachers are relevant (third column).

Table A2. Basic demographic characteristics of leavers and joiners from the teaching force, as compared to the entire teaching force 1998 to 1999						
Charac-teristic	Leavers as a % of those with same characteristic in 1998 database	Joiners in 1999 as a % of those with same char-acteristic in 1998 database	Net leavers as a % of those in the 1998 database	Leavers with the given characteristic as a % of all leavers	Joiners with the given characteristic as a % of all joiners	% of those with the given characteristic in the 1998 database
Gender						
Male	5.37%	1.79%	3.58%	34.8%	32.4%	34.6%
Female	5.33%	1.97%	3.36%	65.2%	67.6%	65.4%
Population group						
African	4.2%	1.6%	2.6%	60.5%	64.4%	76.2%
Coloured	4.8%	2.9%	1.9%	7.5%	12.6%	8.3%
Indian	7.5%	1.4%	6.1%	4.5%	2.3%	3.2%
White	12.0%	3.2%	8.7%	27.5%	20.7%	12.3%
REQV						
10	9.1%	1.6%	7.5%	6.5%	4.2%	3.6%
11	5.8%	0.3%	5.5%	4.6%	0.7%	4.0%
12	3.8%	0.2%	3.6%	11.8%	2.5%	15.5%
13	4.6%	1.7%	2.9%	34.8%	46.1%	38.6%
14	6.2%	1.9%	4.2%	31.3%	36.1%	25.8%
15	4.5%	0.8%	3.7%	8.1%	5.3%	9.1%
16	4.3%	0.5%	3.9%	2.5%	1.0%	3.0%
17	6.5%	0.8%	5.7%	0.4%	0.2%	0.3%

Source: calculated by the author from 1998 and 1999 PERSAL database.
Note: we have not presented standard errors in order to minimise overload on the table. However, in general, all of the implicit differences above are statistically significant. For example, the differences between leaving and joining rates for males and females are statistically significant, as is the difference between joining rates at REQV 13 and 14.

Table A3. Assumptions needed to drive a teacher demand and supply projection			
Assumption	Importance	Degree of reliability	Discussion of numerical values
Picking out a particular demographic projection	High	Medium, and hides at least another 10-15 assumptions	Uncertainty exists as to whether size of population group of school entry age is already declining after having peaked in 1995 or so. The author believes it is, based on analysis of four data sources.
Picking out orphanhood scenarios	High	Medium	Whether orphans should "drive" teacher demand via a specific caregiver-to-orphan ratio, even if for dialogue purposes, and what that ratio should be, is a matter for discussion. Various orphanhood scenarios can be chosen, from a low of 24.3% of the cohort of 5-9 being orphans by 2015, to a high of 28.7%.
Intake rate into grade 1	Medium	Medium	This has been at least 1.0 for many years. It might conceivably decline. However, it is assumed to be 1.0.
Repetition rate in grade 1	Medium	Low	Repetition in the late 1980s and early 1990s was extremely high—as high as 35%-due to recycling of children admitted to school too young, under the assumption they would repeat. Controlled age of admission can reduce this apparent waste. It is assumed repetition declines to at most 10% (in a high enrolment scenario) or 5%) in a low enrolment scenario).
Grade-to-grade apparent or net flow ratios	High	Medium	These have been relatively low, historically, averaging about 93% (for an apparent loss of 7% between grades). In a high enrolment scenario it is assumed this goes up to 97% on average. In a low enrolment scenario it is assumed it stays at 93% on average. This is not to be confused with a true retention ratio.
Desired class size	High, but policy-driven, not a true assumption	High	This is not so much a matter of empirical analysis as a matter of policy setting, either real policy setting or idealised goals. It is assumed at 38 and 35 for primary and secondary respectively.
Period load ("work effort") of teachers; proportion periods taught (includes possibility that principals may have a very low teaching load)	Medium, though to some extent policy-driven rather than a true assumption	Low	This is partly a matter of empirical analysis and partly a matter of policy setting. It is assumed constant at 92% and 87% for primary and secondary respectively. This is a fairly good approximation of current reality.
Rate of substitute teacher usage	High, to some degree policy-driven, not a true assumption	Medium	Partly a matter of policy, partly a matter of necessity. It is assumed that in a best case scenario 2% of teachers at any moment need to be substituted. In a worst case it is assumed 5% will need to be substituted.
Usage of a "special" learner:educator ratio for orphans	High, to some degree policy driven	High	Can be set to any level. A 0-1 switch controls whether the ratio is used at all. The switch is 1 in the worst case scenario. If used, a 10 to 1 ratio is set, but can be re-set.
Assumptions about qualifications distribution of teachers	Low for overall balance, high for skills distribution	High	Not explicitly used to drive overall conclusions. Assumed that as many as 25% would remain under-qualified in primary level even by 2015.
Normal attrition rate of teachers	High	High accuracy of measurement in base year, but extremely susceptible to policy measures.	Measured to be 5.5% (depends a bit on qualifications), and staying at that level. Evidently this ratio is a key driver in the projections, and is very responsive to incentives and actual demand for teachers, as noted in the analysis of compensation and entry and exit rates in this document.
Mortality assumptions for teaching force based on HIV/AIDS scenarios	High	Medium	Normal attrition counts normal mortality. This refers to extra mortality from HIV/AIDS. Ranges from 3.5% by 2015 in the best case to 4.6% in the worst case.
Percent of grade 12 who sit for Senior Certificate Exam	Medium	High	This refers to the percentage of learners in grade 12 who opt for entering and sitting for the Senior Certificate Exam. This ratio is measurable with great accuracy at any given moment, but it is highly susceptible to policy and therefore its future variability is inherently difficult to forecast. A focus on increasing the pass rate could encourage schools to discourage learners who are unlikely to pass from sitting for the exam. This ratio has been at somewhere between 90% and 94% in recent years. It is assumed to stay fixed at 92% in any scenario.
Pass rate on Senior Certificate	Low	High	This refers to the well-known "matric pass rate." It is known with great accuracy in the base year, but it can

Table A3. Assumptions needed to drive a teacher demand and supply projection			
Assumption	Importance	Degree of reliability	Discussion of numerical values
Exam			fluctuate, as was obvious in the results of the year 2000. It is assumed to improve by 3 percentage points in the best scenario and by only 1 percentage point in the worst scenario. The base level is not assumed to be as high as the actual value for 2000, under the cautious supposition that 2000 may have been an exceptional year.
Ratio of headcount enrolment in TTC or tertiary institutions to Senior Certificate passes	High, extremely susceptible to policy	Low	This is a key driver in the system. It is not known with any accuracy whatsoever in the base year, and, on top of this, it is highly susceptible to policy shifts. This ratio drives the enrolment in teacher training institutions. It has been as high as 0.5 in recent memory, when the teacher training institutions were producing bumper crops of teachers, and has sunk to as low as about 0.11 (assuming our best estimates are correct) in 2001. In the best case scenario it is assumed this goes up by 5 percentage points each year. In the worst case it is assumed it decreases to 0.1 and then maintains that level.
Exit or graduation rate from TTC or tertiary institutions	High	Medium	This is a key driver as well. It can be known with reasonable certainty for the base period, based on its value in recent history. It measures, to some degree, the "internal efficiency" of the teacher training institutions, as well as the nominal length of the training programmes. (E.g., with a training programme of four years of nominal length, this ratio would be 0.25.) The ratio is assumed to start at 0.25 and improve to 0.3 in the best case scenario, on the assumption that efficiency can be improved and/or programmes will be shortened. It is assumed to decrease to 0.2 if programmes are long and/or internal efficiency is low.
Percent of those enrolled in TTC or tertiary institutions who are already teachers	High	Medium	Ratio of enrolment that are already teachers and therefore cannot be assumed to drive a replenishing of supply. This has been at approximately 0.45 in recent history. It is intrinsically hard to measure this ratio because the necessary data have not typically been reported in any data documents in the past. Some recent measurements give us some degree of confidence. The ratio is assumed constant at 0.45. Not enough is known about the behaviour of this ratio to justify making any other assumption.
Percent who go on to pursue teaching upon exit from TTC or tertiary institution	High, extremely susceptible to policy	Low	This is a key driver in the system. Its historical value is not known with any certainty because it has never been measured. Furthermore, this ratio is extraordinarily susceptible to policy shifts. It is assumed to have a value of 0.5 in a historical base, to decrease to 0.4 in a worst case scenario, and to improve to 0.9 in a best case scenario.
Base year data on enrolment in all levels of the system	Medium (one might think this is high, but in fact, since in most projections what is interesting is the change over the base, this has only medium importance)	Medium for school level, low for tertiary institutions for 2001	Considerable uncertainty surrounds base year numbers. Discussion of these numbers would take us too far afield. As noted, we are more interested in changes over the base, rather than in absolute numbers per se.
Unit cost data for education programmes in TTCs and tertiary institutions and the effect of economies of scale on such costs	High	Low	This number is not known with much certainty because the cost of places in Colleges of Education in the last few years cannot be taken to be a reliable indicator of true cost, given that they have not operated at maximum efficiency. Costs at tertiary institutions in recent years are somewhat difficult to track because not all institutions report their data. Furthermore, the cost drivers are normally given in terms of Full-Time-Equivalents and other concepts because this is what the funding formula requires, but it is hard to link this up to the headcount concepts that are relevant for projecting teacher supply.

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