Post provisioning

Conceptual framework,

analysis of the data

and way forward

education

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Glossary

The following are key terms used in this analysis. The terms marked with asterisks are those described as 'key concepts' in section 4, and analysed in some depth in that section.

class	Mostly, this means a group of learners as specified in the Annual Survey of Schools. In the Annual Survey of Schools, a class is always a single-grade class. In some parts of this report, however, the definition may be widened to include multi-grade classes (if so, this is made clear).
class L/E ratio*	The number of learners in a class.
class size	In this report, means the same as class L/E ratio.
class teacher	A teacher who has primary responsibility for a class. By definition, the number of class teachers in a school must equal the number of classes.
effective school L/E ratio*	All Grades 1 to 12 learners in a school divided by all full-time teachers (including full-time equivalent teachers).
forced multi-grade teaching*	Teaching of more than one grade in the same class as a result of there being more grade groups than educators in a school.
full-time equivalent teacher	A virtual full-time teacher created when the Principal and one or more Deputy Principals combine their teaching time, and arrive at a number of hours that is at least as high as the average learner contact time of the learners in the school.
full-time teacher	A teacher whose teaching time is sufficient to cover the learner contact time of the most time-consuming grade offered by the school. In addition, a full-time equivalent teacher is considered a full-time teacher in all the statistics provided.
grade group	All the learners in one grade in one school.
grade group size*	The number of learners in a grade group.
learner contact time	The time learners are expected to be in a contact situation with their teachers in the classroom. This is usually expressed as hours per day or per week.
p value	In this report, the *p* value is the proportion of schools-based educators in one school, or in the whole schooling system, who are not class teachers.
post provisioning norms	The official educator post distribution model of the country, contained in Government Notice 1451 of 2002.
raw school L/E ratio*	All learners in a school divided by all educators (either all educators, or only publicly employed educators).
simulation model	In this study, 'simulation model' means a model that simulates a likely allocation of teachers, usually the allocation of full-time

	teachers to classes within each school.
teacher	A post level 1 or 2 educator.
teacher/classroom ratio*	The full-time teachers in a school (including full-time equivalent teachers) divided by the number of classrooms or other rooms suitable for teaching within a school.
teaching time	The time teachers are expected to be in a contact situation with their learners in the classroom. This is usually expressed as hours per day or per week.

Acronyms and abbreviations

The following abbreviations for provinces are used:

EC	Eastern Cape
FS	Free State
GP	Gauteng
KN	KwaZulu-Natal
LP	Limpopo
MP	Mpumalanga
NC	Northern Cape
NW	North West
WC	Western Cape

Other acronyms and abbreviations are as follows:

ASS	Annual Survey of Schools
DoE	Department of Education
ELRC	Education Labour Relations Council
EMIS	Education Management Information System
FET	Further Education and Training
GET	General Education and Training
HOD	Head of Department
IIEP	International Institute for Educational Planning
L/E	Learner/educator
LOLT	Language of learning and teaching
NQF	National Qualifications Framework
PAM	Personnel Administration Measures
PED	Provincial Education Department
SGB	School Governing Body
UNESCO	United Nations Educational, Scientific and Cultural Organization

Executive summary

Section 2 deals mainly with the **policy pressures**. Five policy pressures related to post provisioning stand out in the policy discourse: (1) The problem of over-sized classes; (2) A mismatch between the teacher allocation system and the availability of physical classrooms in schools; (3) Alignment with the school curricula; (4) Managing multi-grade classes; (5) Realising a pro-poor funding pattern with respect to school personnel. The theory (or relative lack thereof) relating to teacher allocation also receives attention in this section.

Section 3 outlines the policy parameters that should govern post provisioning, as they appear in the curriculum and in the labour agreements. The actual versus policy distribution of educator posts across levels also receives attention. Whilst the policy recommendation is for 70% of educator posts in a province to be post level 1 posts, in actual fact PEDs maintain a much higher level of around 78%. PEDs clearly prioritise the employment of classroom teachers, relative to managers within schools.

Section 4 provides a comprehensive analysis using Snap Survey and Annual Survey of Schools data. The analysis begins with the definition of some key concepts.

The analysis of **grade group sizes** reveals that EC is characterised by an exceptional prevalence of small grade groups, which pose exceptional post provisioning problems for this province. Without exceptional budgets, EC must accept that it will experience large classes in some schools well beyond the level experienced in other provinces. This situation is the result of policy choices in the past, not of demographic pressures unique to EC. Over many years the approach in EC in physical planning has been to establish numerous very small schools. Whether this situation can be undone, is debatable.

The **raw school L/E ratio** is examined, where this is understood as learners divided by all educators within one school. Some 15% of learners are in schools with a raw school L/E ratio exceeding 40, whilst for around 20% of learners this L/E ratio is below 30. EC has a greater proportion of learners in schools with a ratio above 45 than the other provinces. If we take into consideration privately employed educators in schools, the national average for the raw school L/E ratio declines from 35 to 33, though the decline is greater in a province like GP where many educators are employed privately (the GP decline is 37 to 33).

The **effective school L/E ratio** is understood as learners divided by the number of educators teaching full-time. In other words, this ratio takes into account the fact that in accordance with policy, some educators are expected to teach part-time and manage part-time (and in some cases manage full-time and not teach at all). In a simulation using the *actual* distribution of educators across schools, but a policy-informed simulation of the utilisation of educators within schools, educators not required to teach full time come to around 21,000. Whilst the raw school L/E ratio is 35.0 at the national level, the effective school L/E ratio is 37.3. In other words, taking into consideration management time in schools raises the school L/E ratio by 2.3 points.

Multi-grade teaching is examined. Around 8% of learners in the country are in schools where some multi-grade teaching takes place. Around 4.5% of learners are in multi-grade classes. This figure varies greatly between provinces, from 9.4% in EC to 0.7% in GP. The implications for educator and management training is discussed. With regard to Principal training, it is important to note that although only around 4.5% of learners are at any point in time in multi-grade classes, a full 30% of schools are forced to practice multi-grade teaching. This is because schools with multi-grade teaching are the smallest schools in the system Clearly it is important for a large proportion of Principals in the country to understand how to manage this phenomenon.

Considerable emphasis is placed on understanding **class sizes** in the schooling system. On the basis of a simulation that uses the existing distribution of educators across schools, and that assumes an optimal utilisation of educators within each school, it is concluded that two-thirds of learners are in classes with 40 learners or fewer, and that 10% of learners are in classes with more than 48 learners. However, a rather different picture emerges if Annual Survey data is used to obtain actual class sizes prevailing in schools. This reality check reveals that only 40% of learners are in classes with fewer than 40 learners, and that 10% of learners are in classes exceeding 69 learners. The phenomenon of very large classes appears to be especially prevalent in more rural provinces. Importantly, a large part of the problem is that educators allocated to *schools* by the PED, are then not allocated to *classes* by school management. Even in primary schools, around 18% of publicly employed educators based in the school are not allocated to classes as class teachers. Policy implies that this figure should be closer to 8%. It is difficult to gauge from the data what the 18% figure means for schools in practical terms, but it is seems clear that teacher utilisation is sub-optimal. Whilst it is logical to expect this problem to be related to the availability of classrooms (teachers without classrooms would be under-utilised), the data indicate that the under-utilisation problem is more or less equally experienced by schools with and without classroom shortfalls, suggesting inadequacies in school management. The TIMSS 2003 dataset confirms the class size pattern found in the Annual Survey reality check. Specifically, TIMSS shows that over 10% of South Africa's Grade 8 learners are in classes with more than 60 learners. Moreover, it shows that even in comparison to developing countries, South Africa's class sizes are high. To some degree, one would expect a situation like this. By developing country standards, South Africa's teacher pay is high. This pushes the L/E ratio and class sizes up. However, what the analysis shows is that the situation is greatly exacerbated by the fact that the number of class teachers in the system is around 20% lower than the number of schools-based educators.

The question of whether there are enough teachers in schools offering Grades 10 to 12 to cater for the **new FET schools curriculum** receives attention. (The adequacy of teacher skills, knowledge and qualifications is not dealt with here. Only the total number of educators is of concern in this analysis.) It is found that even exceptionally small schools offering the FET grades have sufficient publicly employed educators to comply, albeit in a very basic manner, with the curriculum. Around 70% of Grades 10 to 12 learners are in schools that have a sufficient number of teachers to offer 12 FET subjects other than mathematics, English and life orientation (assuming an optimal availability of subject specialisation).

In three provinces, GP, WC and NC, the distribution of **publicly employed non-educators** across schools is relatively adequate and equitable. In most of the other provinces, the inequities are glaring, and in some, notably LP, KN, EC and MP, there are so few non-educators relative to learners that increasing the number of posts seems unavoidable. Whilst we would not expect the percentage of learners in schools with at least one non-educator to be 100% (provisioning non-educators to the smallest schools is arguably not efficient), this statistic is almost certainly too low in LP (24%) and EC (39%).

The relationship between **classroom availability** and teacher distribution is examined. The number of classrooms in the country exceeds what we could consider to be the number of full-time teachers in the country by about 70,000. However, because of the way classrooms and teachers are distributed, there are about 116,000 classrooms 'in excess' in certain schools, whilst some 47,000 class teachers find themselves without classrooms in other schools. Importantly, these figures are obtained using certain policy-based assumptions around who is a full-time class teacher and who is not. In actual fact, schools organise themselves in such a way that they reduce the number of educators in the school who are considered full-time class teachers, thus reducing the number of classes, and the effective classroom shortfalls. This pushes class sizes up, and implies an under-utilisation of teachers (not just in schools with classroom shortfalls, but in even in schools with a sufficient number of classrooms.)

Section 5 compares the **intended and actual effects** of the post provisioning norms. Whilst PEDs appear to be applying the post provisioning norms correctly, there is an important anomaly that arises when we compare the distribution of educators intended by the policy, and that existing on the ground. Very small schools are in fact better provisioned with publicly employed educators than what they should be, according to the norms. There is no obvious explanation for this, but it is likely that PEDs are responding to a real need in small schools by allocating more educators to these schools on an ad hoc basis (after the model has been run). This could suggest that the post provisioning norms should be more generous to small schools than they currently are.

Section 6 reports on the results of two simulations to examine specific post provisioning dynamics.

Firstly, the viability of **a post provisioning model that explicitly caps class sizes** is examined. At first appearance, a distribution model of this type may seem like a viable way of dealing with large classes. However, a modelling of the approach reveals that it would cause undue year-on-year instability with respect to the movement of teachers between schools. It may also introduce new and perverse incentives with respect to grade repetition. Whilst an approach focussing on the L/E ratio at the level of the school may not deal explicitly with the sizes of individual classes, it is better for stability and equity in the system. It should be kept in mind that the existing post provisioning model is to a large extent such a school-level L/E model.

Secondly, the **trade-off between smallest and largest class sizes** within provinces is examined. In practically all teacher distribution models, there is a trade-off between the smallest classes allowed for in small schools, and the resultant size of the largest classes in other schools. The smaller the classes allowed in small schools (and hence the less the extent of multi-grade teaching), the larger the largest classes in other schools. The pattern of this trade-off is modelled on the basis of Snap Survey data. It is found that in many situations, changing the allowance for small classes in small schools has a rather limited effect on the size of the largest classes in the system. For instance, dropping the minimum class size allowed in LP from 20 to 15 decreases class size at the top end by only 0.4 learners. In EC, however, the effect is relatively large. In this province, dropping the minimum class size allowed from 20 to 15 decreases class size at the top end by 1.1 learners. Planners need to know what the shape of the trade-off is.

Section 7 summarises the relationships between the various theoretical and actual L/E ratios that were analysed (including class size), the extent of multi-grade teaching, and the effect of privately paid educators in schools. This is done schematically, with reference to one province, MP.

Section 8 discusses policy implications.

Firstly, the implications for the **design of the post provisioning norms** are discussed. In the 2002 post provisioning norms, the element that requires the most urgent attention seems to be the factor favouring small schools. It should be possible to favour small schools more strongly in the formula. An argument is also made for a complete revamping of the post provisioning norms, to make it more intuitive, and more strongly linked to existing learner contact time and teaching time parameters. Such a revamping should include the development of explicit recommendations for maintaining year-on-year stability in the schooling system, a model to distribute non-educator posts amongst schools and a requirement that PEDs approve when schools should enjoy an advantage for the offering of certain FET subjects (existing curriculum liberties at schools should continue, but the *public* funding of curriculum diversity should be more pro-poor and more controlled).

Secondly, a proposal is made for a management information tool that would assist in making the provisioning of posts a more informed process. The tool would include a facility for producing a form per school outlining not only what public resources were being provisioned to the school, but a suggested utilisation schedule, based on existing policies. These per school forms could establish an important benchmark for class sizes (which are clearly higher than they should be in many schools) and would communicate what the policy was on teacher utilisation.

Thirdly, policy implications for other policies, for example the curriculum and classroom construction, are briefly discussed.

1 Introduction

This report has been produced within Branch P to inform the revision of the post provisioning norms, meaning the post distribution model applicable to schools and published in Government Notice 1451 of 2002[1]. Much of the report consists of a data analysis using the Snap Survey and Annual Survey datasets in order to examine aspects of post provisioning requiring revision. To a large degree, this report supplements a report produced by the Education Labour Relations Council (ELRC) in 2005 titled *Investigation to address post provisioning challenges*. That report involved the gathering of opinions of a variety of stakeholders in relation to the post provisioning norms, as well as some simulating of the post distribution model. However, that report did not include any analysis of data on the *actual* (as opposed to the policy-intended) distribution of employees in schools, and the relationship of this to actual learner and classroom distribution. This report aims to fill that gap.

The target audience of this report is largely provincial and national education planners, specifically those dealing with teacher utilisation. However, those dealing with physical planning, school management, and the school curriculum, should also find this report useful.

The post provisioning norms receive much attention in the policy discourse. In fact, the scope of this policy is narrower than is popularly believed. As the ELRC report points out, it is often not clear amongst stakeholders to what extent problems experienced in terms of teacher provisioning are attributable to (1) the *design* of the post provisioning norms, (2) the *implementation* of the post provisioning norms, and (3) other policies (or policy gaps in other policy areas). For example, inaccurate provisioning of posts is often caused by data problems. This is clearly an implementation problem, though it is possible to tackle this problem more effectively in the design of the policy (proposals in this regard are made in this report). Similarly, instability caused by an excessive year-on-year movement of posts between schools, which is largely attributable to learner migrations and the general downplaying of school zones, could receive better treatment in the post provisioning policy. Problems around the filling of posts distributed to remote rural schools is difficult to deal with through the post provisioning norms, and are best dealt with through more effective incentives, and classroom building programmes. Policy proposals in this latter regard do therefore not receive much attention in this report, though the problem of unequal learner/educator (L/E) ratios resulting from difficulties in filling posts inevitably arises in the data analysis. Finally, the total number of educators employed in the schooling system, and hence the overall L/E ratio, is a function of the budgets of Provincial Education Departments (PEDs) and not the post provisioning norms. These norms simply distribute the number of educator posts that the PED can afford.

Ideally, one should examine post provisioning holistically, within the whole policy framework governing the staffing of public schools. In the current policy framework, Provincial Education Departments (PEDs) are required to distribute educator posts to schools, to fund these posts, and to act as the employer of the occupants of these posts. There is also an expectation that the PED should distribute non-educator posts to schools. The labour market is characterised by central bargaining at the national level, in which the Department of Education (DoE) is deeply involved, to determine the conditions of service of publicly employed educators and non-educators in schools, and PEDs are bound to the resulting agreements. At the same time, School Governing Bodies (SGBs) exercise some power in determining who comes to occupy a publicly funded post, and employees have secured a

[1] The data analysis and report-writing was done by Martin Gustafsson, technical assistant to Branch P (and part of the Integrated Education Programme). Extensive inputs were made by Firoz Patel (Deputy Director-General in Branch P), Pieter Morkel (Director: Educator Planning Provisioning and Evaluation), Dr Thabo Mabogoane and Dr Luis Crouch (both technical assistants to the Branch). Assistance with the data was provided by the EMIS Directorate, in particular Claude Baxter and Hilton Visagie. Collin Mkhize (from Directorate: Economic Analysis) assisted with the data preparation.

number of guarantees that limit the state's ability to transfer employees from one school to another. The employment system governing public employees in public schools in South Africa is thus highly complex, with elements of both central and local control. It was not part of the brief to provide an assessment of the equity and efficiency implications of the current configuration of powers and responsibilities. This configuration is thus taken as a given. The report therefore focuses very much on how the post provisioning norms can be optimised within the existing public school staffing system. It should be regarded as important, however, to aim for a larger, more comprehensive, yet rigorous analysis of this system.

This report was produced at the same time as new implementation tools for the post provisioning norms were developed and tested. The policy proposals at the end of this report are thus informed not only by the analysis undertaken (and reported on here), but also a separate tool-building exercise.

2 Background

2.1 The policy pressures

Five policy pressures related to post provisioning stand out in the policy discourse: (1) The problem of over-sized classes; (2) A mismatch between the teacher allocation system and the availability of physical classrooms in schools; (3) Alignment with the school curricula; (4) Managing multi-grade classes; (5) Realising a pro-poor funding pattern with respect to school personnel.

What are the 'policy pressures' relating to post provisioning? In other words, what policy gaps are said to exist, and what amendments to existing policies are said to be required? Five main policy pressures stand out in the existing documentation and the education planning discourse in the country:

- **Maximum class size.** Education White Paper 1 of 1995 refers to the need for L/E ratios that are 'educationally viable'. The DoE's 2003 *Plan of Action* proposes the following with regard to class size: 'We should … consider declaring a maximum permitted class size, above which the Department should be obliged to take extraordinary and temporary measures' (DoE 2003: 13). The Nelson Mandela Foundation's 2005 report on rural education refers to unacceptably large class sizes, for instance an average of 62 learners per class in the Foundation Phase in KwaZulu-Natal (Nelson Mandela Foundation, 2005: 49).

- **Classroom availability and teacher utilisation.** The matter of an inefficient utilisation of educators where the number of educators allocated to a school exceeds the number of classrooms is referred to by (amongst others) Treasury's *Intergovernmental Fiscal Review*, which speaks of the problem of 'some educators not teaching at full capacity' (National Treasury, 2001: 34).

- **Alignment with the curriculum.** The curriculum stipulates requirements in terms of the time learners need spend to spend in contact with their teachers in specific learning areas. However, the binding policy as far as teachers are concerned is not the curriculum, but the resolutions arrived at in the ELRC. Whilst there is some alignment between the curriculum and the ELRC resolutions, this alignment is far from perfect, and this leads to some policy confusion. This has been argued, for example, in the recent teacher workload study (ELRC, 2005). Moreover, there is uncertainty as to whether the post provisioning norms can in fact provide the teachers needed to implement the new Further Education and Training (FET) schools curriculum.

- **Managing multi-grade teaching.** Whilst the DoE's 2005 *A new vision for rural schooling* (report of the Ministerial Committee on Rural Education) emphasises that multi-grade teaching need not be an impediment to quality schooling, concerns are raised around the ability of Principals and teachers to manage multi-grade situations successfully. The report argues that multi-grade teaching is widespread, with some teachers teaching seven grades at a time (DoE, 2005: 28). Recommendation 28 of this report states, amongst other things, that the post provisioning norms should deal with the issue of multi-grade teaching in a better way. Whilst specifics are not provided, it can be assumed that at the very least, the post provisioning norms should explicitly refer to some parameters regarding multi-grade teaching (currently there is no mention of multi-grade teaching in the post provisioning norms).

- **Progressive (pro-poor) school resourcing.** The previous three points all deal with equity and redress in some way. In addition, it has been argued that the post provisioning norms ought to be used to correct the current pattern of regressive personnel funding – due mainly to qualifications-linked pay and the under-provisioning of non-educator posts to poorer schools, the state actually spends slightly more on non-poor schools than poor schools. By shifting more posts to poorer schools, the post provisioning norms can correct this imbalance. The 2002 amendment of the norms introduced a pro-poor element into the distribution model, but it was not large enough to offset the overall regressive expenditure pattern. Arguably, the distribution model should be more pro-poor. This argument is made in, for instance, the 2005 ELRC report on post provisioning (ELRC, 2005a: 52). Practically, there are two compelling reasons for giving poorer schools more educator posts. Firstly, the educational disadvantage that poor learners experience due to deficiencies in the home can partly be compensated for through smaller class sizes. Secondly, schools serving poorer learners cannot raise the school fees needed to employ additional teachers (a common practice in non-poor schools).

The analysis in this report deals extensively with the first four of the above policy pressures. The fifth one is not analysed, mainly because it has been dealt with an earlier report by the ELRC (2005a). However, all five receive attention in the policy proposals of section 8.

2.2 The theory of teacher allocation

Understanding the theory of teacher allocation becomes especially important in a schooling system where there is a relatively centralised process of distributing actual teachers or teaching posts across schools. Surprisingly, very few theoretical texts could be found in relation to the topic of distributing teachers across schools in a large schooling system (there is more on the distribution of educators *within* institutions). A useful text is the manual on teacher allocation (as well as other teacher supply and demand topics) published by the International Institute for Educational Planning (IIEP) as part of its Fundamentals of Educational Planning series – see Williams (1979). It is unfortunate that there has been nothing of this nature produced since 1979 (at least none could be found).

The theoretical framework, in particular the indicators used and the terminology selected, is in some respects unique to this report. However, Williams (1979) does inform the approach used, and as far as possible the framework and terminology correspond to what is used in the South African policy discourse.

3 Policy parameters

This section summarises key parameters contained in the curriculum and in agreements concluded in the Education Labour Relations Council (ELRC) that have relevance, or may have relevance, for the distribution of educators across schools.

3.1 Parameters from the curriculum

Details on learner contact time, as specified in the relevant curriculum statements, are provided in this section.

- **National policy for designing school calendars for ordinary public schools in South Africa (Notice 207 of 2000).** This policy requires learners to attend school for 195 to 200 days in the year. The policy furthermore requires preparation and closing off activities for educators (but not learners) amounting to at least one day before learners arrive at the beginning of the year and at least three days after learners leave at the end of the year.

- **National policy regarding General Education and Training programmes: Approval of the Revised National Curriculum Statement Grades R-9 (schools) (Notice 710 of 2002).** This policy sets out the weekly learner contact time for each grade in the GET band, and the proportion of this time to be spent on each learning area or programme. The policy refers to *formal* contact time. However, the term *learner* contact time is used here instead to emphasise that this is about the hours *learners* and not necessarily *teachers* need to spend in a contact situation in the classroom. In particular in the FET band, learner contact time and teaching time can become quite distinct (definitions are provided in the glossary). The learner contact time per week in this policy is as follows:

Table 1: Prescribed learner contact time per week in GET band

Grades R to 2	22h 30m
Grade 3	25h 00m
Grades 4 to 7	26h 30m
Grades 8 to 9	27h 30m

- **National policy regarding Further Education and Training programmes: Approval of the Document, the National Senior Certificate: A Qualification at Level 4 on the National Qualifications Framework (NQF) (Notice 744 of 2005).** This policy sets out the weekly learner contact time for each grade in the FET band, and the proportion of this time to be spent on each learning area or programme. The learner contact time per week is as follows:

Table 2: Prescribed learner contact time per week in FET band

Grades 10 to 12	27h 30m

Learners are expected to each take at least seven subjects, as follows, and with the following weekly hours:

Table 3: Prescribed learner contact time per week per FET subject

Group A	Language 1	04h 30m
	Language 2	04h 30m
	Life Orientation	02h 00m
	Mathematics/Mathematical literacy	04h 30m
Group B	Core subject 1	04h 00m
	Core subject 2	04h 00m
	Elective subject	04h 00m
	TOTAL	27h 30m

Languages 1 and 2 must be two of the 11 official languages. The two core subjects plus the elective subject are selected from a list that comprises 25 subjects plus an unspecified number of languages that are not the official languages. A school that offered every possible subject would offer 39 subjects (this excludes possible foreign languages) – 11 official languages plus life orientation plus mathematics plus mathematical literacy plus 25 other subjects. The first four subjects or subject options in Table 3 belong to what is known as ‘Group A’, whilst the last three belong to ‘Group B’.

- **National policy regarding instructional time for school subjects (Notice 1473 of 1999).** This policy lays down the ‘instructional time’ required per grade in the schooling system. The time specifications in this policy are the same as those appearing in the curriculum policies discussed above. Notice 1473 of 1999 receives mention here partly because it is referred to in the recent ELRC (2005: 6) teacher workload study, where it was considered (incorrectly, it seems) as the policy basis for the time teachers are required to teach. The correct policy basis for teaching time is the Personnel Administration Measures (PAM), discussed below. The policy contradiction pointed out by the ELRC still stands, however. We would expect, especially in the lower grades, for there to be a strong correspondence between teaching time and learner contact time. This matter receives further attention in section 3.3.

3.2 Parameters determined by labour agreements

This section provides details on the time teachers are expected to teach, and guidelines on the proportion of managers to non-managers in the schooling system.

- **Personnel Administrative Measures (Notice 222 of 1999 as amended up to Notice 267 of 2003).** This policy contains a number of key specifications.

  This policy stipulates that the ‘formal day’ during which educators must be present at school is at least seven hours. Guidelines for the proportion of the formal day to be spent on ‘scheduled teaching time’ are given, according to post level:

Table 4: Recommended proportion of formal day to be spent teaching

	Primary school	*Secondary school*
Post level 1	85% to 92%	85% to 90%
Post level 2	85% to 90%	85%
Deputy Principal (post level 3)	60%	60%
Principal	10% to 92%	5% to 60%

The above implies, for example, that the minimum number of hours that a primary school teacher ought to teach per day is 85% of seven hours, or 5.95 hours a day, or 29.75 hours in a five day working week. The weekly teaching time in hours, calculated on the basis of the above parameters and the seven hour formal day are as follows:

Table 5: Teaching time per week

	Primary school	*Secondary school*
Post level 1	29h 45m to 32h 12m	29h 45m to 31h 30m
Post level 2	29h 45m to 31h 30m	29h 45m
Deputy Principal (post level 3)	21h 00m	21h 00m
Principal	03h 30h to 32h 12m	01h 45m to 21h 00m

The policy explains that the category ‘scheduled teaching time’ should be regarded as separate from ‘relief teaching’. This implies that teachers can be required to relief teach beyond their scheduled teaching time, as long as the seven hours per day limit is not exceeded.

A recommended proportion of educator posts at different levels, for the public education system of the province as a whole, is specified in the policy:

Table 6: Recommended distribution across educator post levels for a province

Post level 1	69.720%
Post level 2	18.220%
Post level 3	8.450%
Post level 4	3.420%
Post level 5	0.095%
Post level 6	0.095%
TOTAL	100.000%

The above recommended distribution is being revised to make it more school-specific. For instance, the new policy will say that every n^{th} educator post in a school should be a post level 2 post (see next policy entry below).

In the policy, the post level of the school principal depends on the enrolment of the school. The following parameters are given:

Table 7: Prescribed post levels of school principals

	Learners	*Post level of principal*
Primary school	Up to 60	1
	61 to 119	2
	120 and above	3
Secondary/combined school	Up to 79	1
	80 to 159	2
	160 to 719	3
	720 and above	4

The above parameters are also being revised. In future, principals will be differentiated not by post level, but by salary notches, depending on school size.

- **ELRC Collective Agreement number 3 of 2006.** This agreement specifies the new grading system for Principals. Principals are to be placed into one of seven salary levels, ranging from level 6 to level 12, depending on the number of publicly employed educators in the school. This agreement raises two key questions relating to the provisioning of posts to schools. Firstly, how does the new agreement affect, if at all, the recommended distribution of educators across post levels reflected in Table 6? It should be remembered that the post level of school principals affects the number of Deputy Principals (post level 3 educators) and Heads of Department (post level 2 educators) that a province employs, if the recommended breakdown from Table 6 is followed. Essentially, then, the question is what the post level of Principals becomes with the new agreement. Reportedly, the intention is for all Principals except for those in the very smallest schools to be considered post level 4 educators, though formal policy in this regard is still required. Secondly, there is the question of how the new agreement affects the teaching time requirements of Principals, if at all. Do the teaching time ranges for Principals in Table 5 still hold? Reportedly, there is a move towards making the minimum teaching time for all Principals zero hours. This obviously has implications for the number of educator posts required by each school, given that currently many Principals do teach full-time.

3.3 Summary of teaching time and learner contact time parameters

Whilst Principals and Deputy Principals do not have enough prescribed teaching time to teach any grade on a full-time basis, Heads of Department and post level 1 teachers have more than enough prescribed teaching time to fulfil the learner contact time requirements of any grade.

The next table summarises what the curriculum and labour agreements say about learner contact time and teaching time, in hours per week.

Table 8: Learner contact time and teaching time

<table>
<tr><th colspan="4">Teaching time</th><th rowspan="2">Learner contact time</th><th rowspan="2"></th></tr>
<tr><th>Teacher (PL1)</th><th>HOD (PL2)</th><th>Deputy (PL3)</th><th>Principal (any PL)</th></tr>
<tr><td rowspan="4">29h 45m to 32h 12m</td><td rowspan="4">29h 45m to 31h 30m</td><td rowspan="4">21h 00m</td><td rowspan="3">03h 30m to 32h 12m</td><td>22h 30m</td><td>Grades 1 to 2</td></tr>
<tr><td>25h 00m</td><td>Grade 3</td></tr>
<tr><td>26h 30m</td><td>Grades 4 to 7</td></tr>
<tr><td>01h 45m to 32h 12m</td><td>27h 30m</td><td>Grades 8 to 12</td></tr>
</table>

A few things stand out in the above table. Firstly, the minimum teaching time required of post level 1 teachers and Heads of Department (post level 2 educators) exceeds the learner contact time across all grades. These teachers are thus able to work as full-time teachers in any grade. Secondly, no Deputy Principals (post level 3 educators) have enough teaching time to work as full-time teachers in any grade. Fourthly, a Principal may have enough teaching time available to be a full-time teacher, and may not. Fifthly, a Deputy Principal and a Principal may together have enough teaching time to provide the time needed for a full-time teacher. For example, a Principal in a primary school with the minimum teaching time of 03h 30m could combine his or her time with a Deputy Principal's teaching time of 21h 00m, to produce enough teaching time for the learner contact time of a Grade 1 class (but not, say, a Grade 3 class). We can thus speak of a 'full-time equivalent teacher' being created. The figures in the table suggest that such combinations would tend to be more feasible in primary schools than in secondary schools. (A proviso with regard to primary and secondary schools should be noted. About 20% of learners in the country are in schools with a mix of primary and secondary grades. Only 64% of learners are in 'perfect' primary or secondary schools, meaning schools with exactly the Grades 1 to 7 range or exactly the Grades 8 to 12 range. Only 55% of *schools* are 'perfect' primary or secondary schools. The terms primary and secondary schools should thus be used with caution.)

3.4 The actual distribution of the post levels across provinces

Whilst the policy recommendation is for 70% of educator posts in a province to be post level 1 posts, in actual fact PEDs maintain a much higher level of around 78%. PEDs clearly prioritise the employment of classroom teachers, relative to managers within schools.

A short analysis of the actual distribution of educators across the post levels referred to in Table 6 is given here. This is not incorporated into the major analysis and simulations of section 4, mainly because the Snap Survey data used in that section does not deal with the post levels of educators. Instead, it is necessary to use Persal data to obtain a profile of the post level distributions. The aim here is largely to gauge the extent to which provinces deviate from the recommended distribution of Table 6. We should bear in mind that those recommendations are currently being amended, so this analysis might inform those amendments.

An October 2005 national download of Persal yields the following statistics for the provincial education systems as a whole (not just schools):

Table 9: Percentage distribution of post levels amongst educators

	1	*2*	*3*	*4*	*5*	*6*	*Total*
EC	79.0	10.4	3.8	6.2	0.6	0.1	100.0
FS	75.9	12.6	5.1	5.4	0.9	0.1	100.0
GP	76.7	13.9	5.0	3.5	0.8	0.1	100.0
KN	75.0	14.0	4.0	6.2	0.6	0.2	100.0
LP	86.1	5.4	3.4	4.7	0.2	0.0	100.0
MP	78.0	11.3	4.4	5.4	0.7	0.1	100.0
NC	75.4	13.4	4.9	5.3	0.9	0.2	100.0
NW	75.9	12.5	4.4	6.4	0.6	0.2	100.0
WC	76.8	13.1	4.7	4.8	0.6	0.1	100.0
SA	78.2	11.5	4.2	5.4	0.6	0.1	100.0
Benchmark	69.7	18.2	8.5	3.4	0.1	0.1	100.0

It is clear that the actual distribution favours post levels 1 and 5 a lot more strongly than the policy guidelines (see 'Benchmark' in the above table), at the cost of post level 2, 3 and 4 educators. Post level 3 educators are especially scarce, relative to the benchmark. Two forces seem to be making PEDs deviate from the guidelines. Firstly, the need to put a teacher in front of every class, and the need to reduce class sizes, is making PEDs employ more post level 1 teachers than is recommended in the guidelines. Secondly, the need to strengthen management in PED offices is making PEDs employ more post level 5 educators than what is recommended. These needs have been met at the cost of management within schools, in the form of post level 2, 3 and 4 schools-based managers. This is not to say that PEDs have managed the situation sub-optimally. It could well be that the recommended distribution of Table 6 is not optimal. It should be kept in mind that the recommended distribution is more a result of negotiation and perceived ideals, than of any in-depth study into what is efficient or what schools themselves perceive the need to be.

The next table indicates the distribution in just schools (there is no policy benchmark for this).

Table 10: Percentage distribution of post levels amongst schools-based educators

	1	*2*	*3*	*4*	*Total*
EC	79.0	10.7	3.5	6.7	100.0
FS	76.8	13.5	3.8	6.0	100.0
GP	77.0	14.8	4.3	3.9	100.0
KN	75.0	14.6	3.7	6.7	100.0
LP	87.0	4.9	3.2	5.0	100.0
MP	78.4	12.4	3.4	5.8	100.0
NC	77.2	13.5	3.5	5.8	100.0
NW	77.3	13.0	3.3	6.4	100.0
WC	78.0	13.1	4.0	4.9	100.0
SA	78.8	11.8	3.6	5.8	100.0

Post level 5 and 6 posts are not distributed to schools. Largely, the schools-based distribution mirrors the overall distribution. This is to be expected given the size of the schooling system. The schooling system absorbs 89% of all educator posts employed by PEDs, and this figure ranges from 83% in the case of GP to 93% in the case of LP.

4 The current distribution of employees, learners and classrooms

Post distribution is a complex matter. Discussions and the analysis can be assisted by a set of indicators and graphs that focus on key issues. This section presents a recommended set of indicators and graphs that can represent the distribution of employees, learners and classrooms, and the relationship between the three.

4.1 Key concepts

The following terminology will be used:

- **Grade group size.** This is the total number of learners in one grade in one school.

- **Raw school L/E ratio.** This is the ratio of learners to all educators (regardless of post level or management status) within one school. This statistic may include or exclude privately employed educators.

- **Effective school L/E ratio.** This is the ratio of learners to teachers who can teach full-time in one school. Educators in management positions are often not expected to teach full-time. However, it is possible for the part-time teaching time of two managers to equal the time of one full-time teacher, and for the purposes of this indicator, that virtual full-time equivalent 'teacher' would be counted as part of the denominator E. Further details on this are provided below. The effective school L/E ratio indicates what the average class size in a school is.

- **Forced multi-grade teaching.** This occurs when there are fewer educators allocated to a school than there are grade groups. In such a situation, the school is forced to merge one or more grades.

- **Class L/E ratio.** This is popularly referred to as 'class size'. It is the number of learners in one class after classes, with their class teachers, have been determined in the school. This determination may involve the splitting of single grades into several classes, and may involve the merging of grades into multi-grade classes.

- **Classroom shortfall.** This is classrooms minus full-time teachers (including full-time equivalent teachers) in one school. Classroom includes any kind of instructional room, for example ordinary classrooms, workshops, media centres and libraries. If the classroom shortfall is 1 or more, there are more teachers than classrooms, and there is the possibility that teachers are teaching outside, are sharing the same classroom with other teachers, or are simply not teaching when they should. On the other hand, if the classroom shortfall is a negative value, there are more classrooms than teachers, and there is the possibility that some classrooms are not being used during the school day.

4.2 Data issues

The variables used for the data analysis are discussed, and data sources are explained. The available data provide a relatively good basis for analysing the relationship between teacher, learner and classroom numbers in schools, though there are some gaps. In particular, the LP data on teachers and learners is problematic, and for a number of provinces much of the classroom data is older than one would want.

For the analysis of section 4, it was necessary to obtain the following data from each public ordinary school in the country:

- Enrolment per grade, for Grades 1 to 12.

- Number of publicly employed educators.
- Number of privately employed educators.
- Number of publicly employed non-educators.
- Number of instructional rooms.

Grade R enrolment data was deliberately excluded, because the intention was to deal with the distribution issues relating to the 2002 post provisioning norms, which focus on Grades 1 to 12 (the staffing of Grade R is dealt with separately in line with Education White Paper 5 and a new funding norm, the first draft of which appeared in Government Notice 1865 of 2006).

It would have been beneficial to obtain data relating to the number of managers at post levels 2, 3 and 4 at each school. However, this was not readily available, and this gap influences the analysis of 'effective school L/E ratios' in section 4.5. (The data on managers is available in Persal, but linking Persal to EMIS data using school identifiers is not possible to the required level.)

The data for the variables listed above was obtained from the 2005 and 2004 Snap Survey datasets (for the learner and staff counts) and the 2004 Annual Survey of Schools and 2000 Schools Register of Needs datasets (for instructional rooms). The reason why the earlier 2004 Snap Survey dataset was used is that the 2005 dataset was not fully populated and cleaned in time for this study, and hence gaps were filled using the 2004 Snap Survey data. Similarly, the 2000 Schools Register of Needs dataset was used to fill in the gaps left by the 2004 Annual Survey of Schools dataset. The following table indicates the level of success in obtaining data from the four data sources. The number of public ordinary schools in the country according to the DoE's *Education Statistics in South Africa at a Glance in 2004* (the most recent publication with official data on school numbers) was used as the benchmark to gauge the success level.

Table 11: Data sources

	Schools in Stats at a Glance (2004)	*Learner and staff counts (counts refer to schools)*				*Instructional rooms (counts refer to schools)*		
		2005 Snap used	*2004 Snap used*	*% of all schools*	*% learners*	*2004 ASS used*	*2000 SRN used*	*% of all schools*
EC	6,100	6,013	2	98.6%	99.7%	5,847	165	98.6%
FS	2,009	1,809	179	99.0%	100.8%	972	1,006	98.5%
GP	1,861	1,864	16	101.0%	99.6%	1,642	224	100.3%
KN	5,693	5,593	89	99.8%	100.8%	5,539	77	98.6%
LP	4,196	4,131	68	100.1%	100.7%	2,341	1,824	99.3%
MP	1,853	1,715	84	97.1%	100.7%	1	1,658	89.5%
NC	425	419	7	100.2%	100.0%	294	130	99.8%
NW	2,184	1,995	189	100.0%	108.1%	1,743	421	99.1%
WC	1,451	1,450	3	100.1%	99.9%	1,444	0	99.5%
SA	25,772	24,989	637	99.4%	100.9%	19,823	5,505	98.3%

Records with both learner and the required staff data came to more than 99% of the number of the official count of 25,772 schools. In other words, there were 25,626 schools available for the analysis in this regard. The column *% learners* is the proportion of the official 2005 learner count for public ordinary schools represented by the learners in the datasets used. The success rate for infrastructure was lower, with instructional room data from 2004 being available for only 77% of schools, though the figure rises to 98% if older 2000 data on classrooms is used to fill the gaps. To control for the possible effects of using rather old classroom data, the analysis in section 4.10 occurs both with and without the 2000 data.

Two issues about the data deserve special mention, because they could potentially influence the findings of the analysis.

Firstly, the number of educators can fluctuate throughout the year. This is strongly linked to the number of temporary educator employees in the system. The following table compares the published 2004 *Statistics at a Glance* educator counts against the educator count from the dataset used for this analysis (and derived from a mix of 2004 and 2005 Snap Survey records) and against the October 2005 download of Persal.

Table 12: Educator counts

	Stats at a Glance (2004)	*Dataset used for analysis*	*Persal (Oct 2005)*
EC	63,498	62,196	62,317
FS	22,451	22,080	22,288
GP	40,916	43,752	42,997
KN	79,011	73,837	76,650
LP	52,571	55,022	57,688
MP	25,631	25,365	26,090
NC	6,067	6,133	6,466
NW	29,752	28,535	29,347
WC	25,180	25,517	26,609
SA	345,077	342,437	350,452

The most relevant comparison is between the last two columns, which both refer to the same year, 2005. (Whilst some 2004 data was used in deriving the statistics in the middle column, Table 11 indicates that the bulk came from the 2005 Snap Survey.) The provinces with the largest in-year fluctuations, according to these figures, are LP and NC. In these two provinces, the Persal count is between 3% and 4% higher than the count in the middle column. This is not surprising, given the dynamics of educator employment in the system. In January, when the Snap Survey is run, the number of temporary teachers is often low, as the system is still waiting to confirm the employment of these teachers in response to enrolment shifts in the new school year. By October, on the other hand, the system is relatively settled, and temporary teachers have been placed where they are needed.

One reason why the Persal count in the last column would be higher than the count in the middle column is that the Persal count would include both substitute educators, and the educators they were substituting for. In the case of the Snap Survey data used for this analysis, substitute teachers, who are clearly indicated as such in the survey, were not counted in the analysis, given that the educators they are substituting are also counted in the survey. In other words, a double-count was avoided. There were around 2,900 substitute educators in the system in 2005.

Secondly, publicly employed Grade R teachers are included in the count of educators in the Snap Survey, and there is no way of separating them from other educators. This means that the educator data used for this analysis includes some Grade R teachers, even if the focus is on Grades 1 to 12. However, judging from separate data sources relating to ECD, it seems as if only in the case of LP would this influence the analysis substantially. In that province, publicly employed Grade R educators amount to 5% of all publicly employed educators in schools. In other provinces, the figure is around 1%, so the effect on the analysis would be minimal.

Clearly, the findings for LP should be regarded with much caution, as both data issues are a strong element in the case of this province. For this reason, there is only limited interpretation of the LP statistics in the analysis.

4.3 The distribution of 'grade group sizes'

'Grade group size' (the number of learners enrolled in one grade in one school) is arguably the most important determinant of whether economies of scale can be attained in individual schools in the delivery of the curriculum. The greater the proportion of learners in a province in small grade groups, the more the province is forced to allocate teachers towards small grade groups, and away from larger grade groups. This raises class sizes in schools with larger grade groups (these schools are always the majority). The data show that EC is characterised by far more learners in small grade groups than the other provinces (though these small grade group learners are still the minority in the province). This presents a structural challenge for this province. Without a major amalgamation of schools, and with average per learner funding levels that are not higher than in other provinces, EC must accept that the majority of learners will have substantially larger classes than in other provinces. Importantly, the prevalence of small grade groups in EC is largely the result of policy choices made in the past, and not the result of exceptional rurality in the distribution of the province's population.

Both school size and grade group size are important economy of scale parameters within a school. The larger the school, and the larger the grade groups within schools, the smaller the possibility of exceptionally large or small classes, and the less the need for multi-grade teaching. It may seem contradictory that larger schools reduce the possibility of exceptionally large classes. However, within an equitable teacher distribution system, this holds true. Larger schools are in a better position to smoothen spikes in the distribution of learners across grades, because they can establish many classes in each grade. Medium sized schools may be forced to live with these spikes, and hence exceptionally large classes in particular grades. The next table illustrates this, through reference to two hypothetical schools. School B is exactly three times as large as school A, in terms of learners per grade and the total number of class-based teachers. School A is essentially forced to allocate one teacher to each grade. School B, on the other hand, can vary the number of teachers in each grade. Thus, although the L/E ratio at the level of the school is identical in the two schools, the maximum class size in School A is higher than that in School B.

Table 13: Effect of school size on class L/E ratio

	School A			*School B (exactly 3 times size of School A)*		
	Learners	*Teachers*	*L/E*	*Learners*	*Teachers*	*L/E*
Gr 1	54	1	54	162	4	41
Gr 2	29	1	29	87	2	44
Gr 3	41	1	41	123	3	41
Gr 4	50	1	50	150	4	38
Gr 5	36	1	36	108	3	36
Gr 6	38	1	38	114	3	38
Gr 7	32	1	32	96	2	48
Total	280	7	40	840	21	40
Maximum class L/E			54			48

In the following table, average school sizes per province are given. The average across schools is calculated by dividing total enrolment by the number of schools. The average across learners is calculated by dividing the sum of school size experienced by each learner (there is thus one value per learner) by the number of learners. Because, by definition, there are more learners in larger schools, the latter average is always higher than the former average. That the two statistics can yield opposite results is indicated by the EC and FS statistics. Whilst the average school in FS is smaller than the average school in EC, the school size of the average learner in EC is substantially lower than that in FS. For planning purposes, it is often the second statistic that is more meaningful, as it provides a more accurate picture of the situation experienced by the learner. The focus in most of this analysis is on such averages across learners. With respect to school size, it will become clear that in many ways the small school problem is a more serious challenge in EC than it is in FS. The national statistics in Table 14 (and in the other tables that follow) are calculated in the same way as the provincial statistics.

Table 14: Averages for school size and 'grade group size'

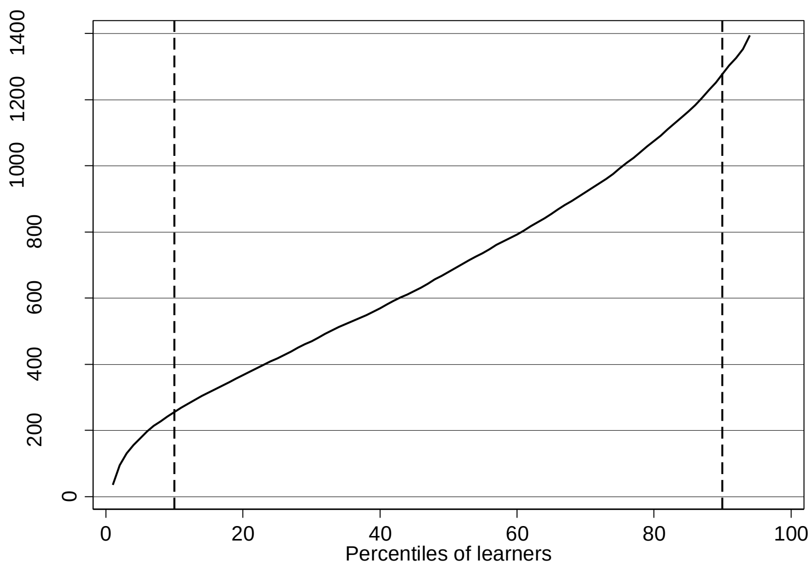
	School size		Grade group size		FET grade group size	
	Avg. across schools	Avg. across learners	Avg. across grades	Avg. across learners	Avg. across grades	Avg. across learners
EC	342	545	50	97	125	204
FS	323	820	54	161	150	233
GP	825	1045	133	196	224	284
KN	459	684	76	131	119	176
LP	428	618	72	118	104	159
MP	491	822	79	154	157	231
NC	469	765	71	145	121	200
NW	409	709	72	173	153	238
WC	630	944	95	171	173	248
SA	451	739	72	142	135	210

Source: Snap Survey, 2005 and 2004.

Table 14 makes it clear that EC learners are subject to grade group sizes that are substantially lower than that of any other province. As will be seen below, the fact that the average learner in EC is in a grade group consisting of 97 learners comes about as a result of a large proportion of learners in this province finding themselves in exceptionally small grade groups of below 35 learners. Across all provinces, grade group sizes at the FET band are higher, and this makes it feasible to implement curriculum diversity, as required in the 2003 curriculum for FET (more details on this in section 4.8).

Figure 1 provides a graphical representation of the distribution of school sizes. The horizontal axis represents percentiles (or one-hundredths) of learners, sorted from those in the smallest schools, to those in the largest schools. The vertical axis represents school size. Dotted lines indicate the 10th and 90th percentiles.

Figure 1: Distribution of school size (national)



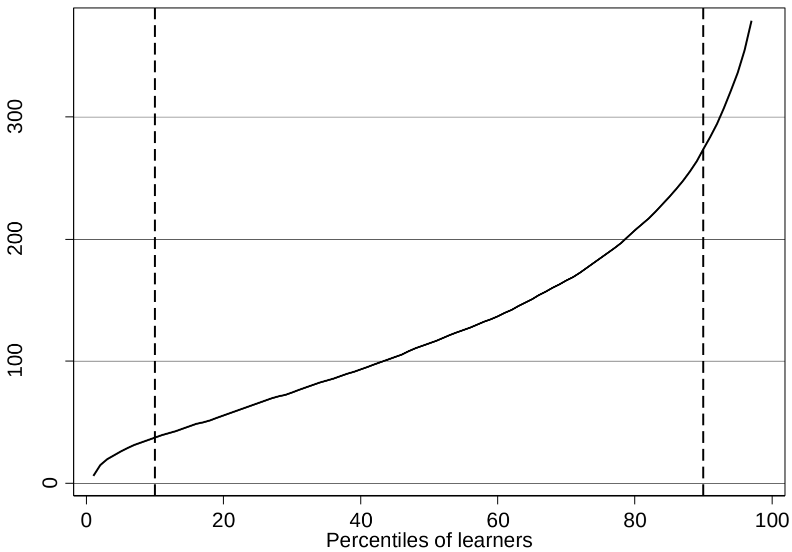
Some examples of what the above graph is saying:

- 10% of learners are in schools with fewer than 250 learners.
- 10% of learners are in schools with more than 1,250 learners.

An interesting observation based on the dataset is the following: Although 6.4% of schools in the country had fewer than 35 learners, only 0.2% of learners found themselves in such schools. The challenge of provisioning small schools is hence fairly large in terms of the institutions that need to be served, but in terms of the learners affected, the issue is small in magnitude.

The same contrast exists with respect to grade group sizes (illustrated in the next graph). Only 4% of learners find themselves in grade groups of 20 learners or less, but a whole 20% of the grade groups in the country have only 20 learners or less. It is easy to show that the country could never afford to provide at least one teacher for each grade group. The result would be extremely high L/E ratios in those schools with large grade groups. Some merging of grades, resulting in multi-grade teaching, is inevitable. The crucial planning question is what the cut-off for providing a teacher per grade should be. Should grades with at least 15 learners be taught by one teacher? Or should the cut-off be 20 learners? The lower this cut-off is, the greater the price that needs to paid in terms of larger classes in non-small schools (assuming, of course, that the total number of educators remains constant). The trade-off is dealt with in greater depth in section 6.2.

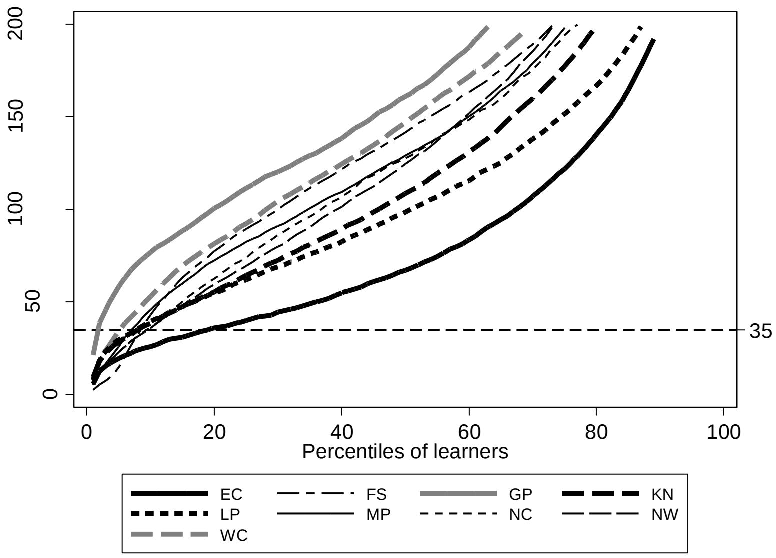
Figure 2: Distribution of grade group sizes (national)



Some examples of what the above graph is saying:
- 10% of learners are in grade groups with fewer than 38 learners.
- 10% of learners are in grade groups with more than 270 learners.

Provincial curves for the distribution of grade group sizes are illustrated in the next graph. Clearly, the provinces are structurally very different. These are structural issues that are difficult to change. Note that we have not brought in the question of teacher distribution yet – the distribution of grade group sizes is purely a matter of learner distribution across grades within schools. The graph has been truncated at the top in order to allow for a better picture of the distribution of small grade groups. The horizontal dotted line runs through 35 learners per grade.

Figure 3: Distribution of grade group sizes (provinces)



Some examples of what the above graph is saying: ▪ 20% of learners in EC are in grade groups smaller than 35. In all the other provinces, the proportion of learners in grade groups smaller than 35 is always less than 10%. ▪ 80% of learners in GP are in grade groups larger than 100.

With respect to small grade groups, EC stands out as being exceptional. In all other provinces, fewer than 10% of learners are in grade groups smaller than 35, whilst in EC the figure is 20% of all learners. We can expect this to translate into an exceptionally high shift in educator posts away from larger schools, towards smaller schools (and hence larger classes in larger schools). This is of course assuming that the distribution model contains an advantage for small schools (this is the case with the 2002 post provisioning norms).

The question should be asked to what extent the exceptional situation in EC is a result of population distribution in the province, and to what extent it has been a policy choice in the past to have more small schools, as opposed to fewer and larger schools. Table 15 provides some contextual statistics from the 2004 General Household Survey. The population in EC is only the third-most rural, in terms of the proportion of the population being ‘non-urban’, yet the province has the smallest schools and the smallest grade groups. We would expect this to have a positive and downward effect on travelling time between the home and the school. Indeed, travelling time in EC is only the sixth-longest. Only the two urban provinces, GP and WC, and FS, have travelling times that are shorter than those of EC. The small grade group situation in EC seems to be more a matter of policy choices in the past, than of demographic necessities. There are thus no strong demographic reasons standing in the way of a more consolidated schooling system, meaning the merging of schools in order to bring about the economies of scale mentioned above, and hence lower class sizes in non-small schools. However, there may be other, political or practical reasons that would make such an initiative on a large scale difficult or impossible.

Table 15: Rurality statistics

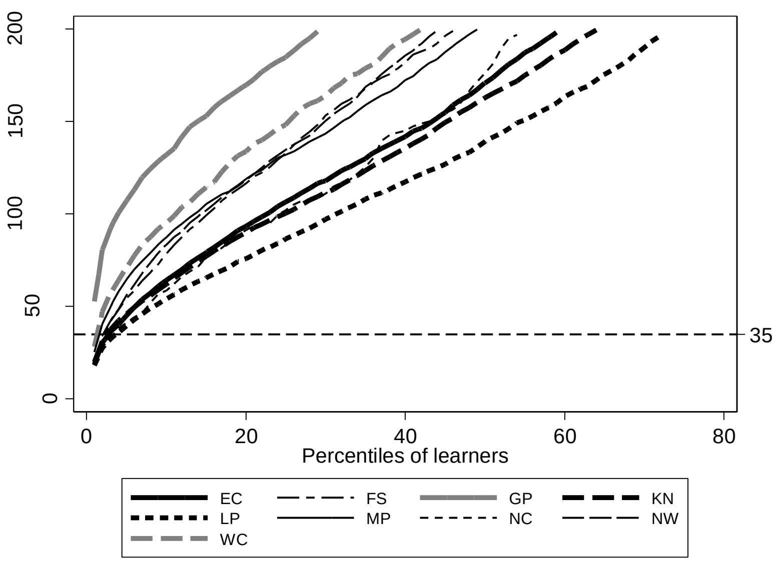
	Proportion of non-urban population		*Grade group size (avg. across learners)*		*Avg. travelling time in minutes from household to closest primary school*	
EC	63%	3	97	1	19.9	6
FS	35%	7	161	6	18.9	7
GP	4%	9	196	9	16.1	8
KN	45%	5	131	3	22.1	2
LP	85%	1	118	2	19.9	5
MP	61%	4	154	5	20.9	3
NC	37%	6	145	4	25.9	1
NW	65%	2	173	8	20.9	4
WC	11%	8	171	7	13.2	9
SA	41%		142		19.0	

Source: General Household Survey 2004. The proportion of non-urban population per province is what Stats SA uses in its GHS sampling frame. To calculate the average travelling time of learners, the mid-points of the bins specified in the GHS were used, e.g. 0 to 15 minutes became 7.5 minutes. Rank 1 always refers to the value one would most associate with a high level of rurality.

If there are provinces that should perhaps have *smaller* grade groups (and schools) on average in order to make schooling more accessible to the population, it is NC, and possibly KN. In NC, the average travelling time of almost 26 minutes is well above that for the other provinces. In fact, 9% of households in NC report that the closest primary school is over 60 minutes away, against a national figure of 2%.

Small grade group sizes is barely a problem with regard to the FET grades. In EC, to take an example, only 3% of FET learners are in grades with fewer than 35 learners.

Figure 4: Distribution of FET grade group sizes (provinces)



Some examples of what the above graph is saying:

- Fewer than 5% of learners in LP are in grade groups smaller than 35 in the FET band.
- Over 95% of learners in GP are in grade groups larger than 100 in the FET band.

4.4 The distribution of 'raw school L/E ratios'

The 'raw school L/E ratio' is learners divided by all educators within one school. As one might expect, learners experience very different raw school L/E ratios, depending partly on the province they find themselves in, and partly on other factors such as the post provisioning model. Some 15% of learners are in schools with an L/E ratio exceeding 40, whilst around 20% of learners are in schools with an L/E ratio below 30. If we take into consideration privately employed educators in schools, the national average for the raw school L/E ratio declines from 35.2 to 33.5, though the decline is greater in a province like GP where many educators are employed privately (the GP decline is 37 to 33).

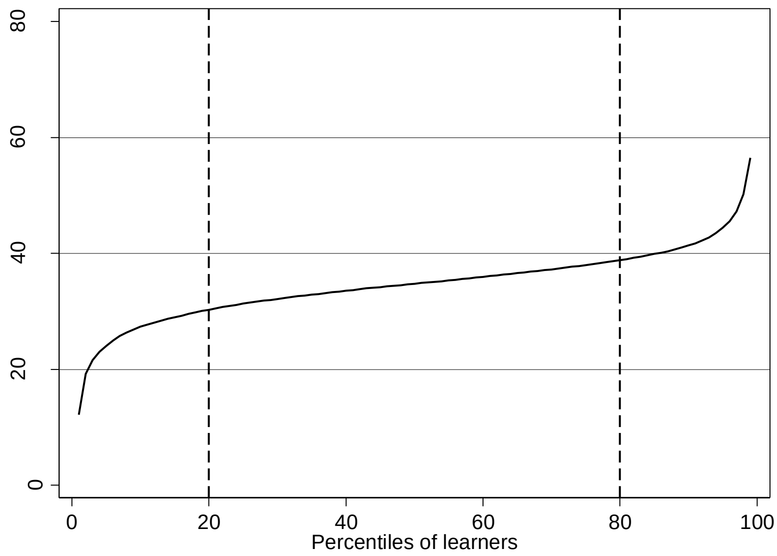
The raw school L/E ratio, understood here as the learners of a school divided by all the educators of the school, is a commonly used statistic. The next table shows two distributions for the raw school L/E ratio, one that considers only publicly employed educators within E, and one that includes privately paid educators within E. Obviously, bringing SGB-employed educators into the equation yields a raw school L/E ratio that is somewhat lower. Nationally, the difference is around 2 learners per educator (using the averages across learners). Specifically, if we take the raw school L/E ratio experienced by the average individual learner in the country counting only publicly employed educators, we obtain a ratio of 35.2. If we also count privately employed educators, we obtain a ratio of 33.5. The difference between the two ratios is obviously greater in provinces where schools employ many educators on a private basis. Hence in GP, the difference between the two ratios is 3.4 (36.8 minus 33.4). In a province such as LP, where few educators are employed privately, there is a negligible difference between the two ratios. The 'Avg. across schools' statistics have also been provided in Table 16, and they are consistently lower than the 'Avg. across learners' statistics due to the fact that in the 'Avg. across schools' statistic each school is weighted equally, regardless of its size (the contrast is particularly large in FS, a province with many small schools with low L/E ratios).

Table 16: Averages for the 'raw school L/E ratios'

	learners per educator (public)		learners per educator (public + private)	
	Avg. across schools	Avg. across learners	Avg. across schools	Avg. across learners
EC	31.6	35.4	30.4	34.0
FS	22.2	30.6	21.6	29.8
GP	36.0	36.8	32.3	33.4
KN	34.5	36.5	32.9	34.7
LP	31.3	33.9	31.0	33.5
MP	32.5	35.9	31.2	34.6
NC	30.1	33.8	28.3	32.1
NW	28.8	33.1	28.0	32.1
WC	34.5	36.4	30.3	32.5
SA	31.7	35.2	30.3	33.5

The next graph illustrates the distribution of raw school L/E ratios without taking into consideration privately employed educators in public schools. What stands out is the increase in the gradient of the curve beyond the 90^{th} percentile. This part of the graph represents largely the failure of some schools to attract teachers to fill posts (though this could partly also be the result of incorrect data).

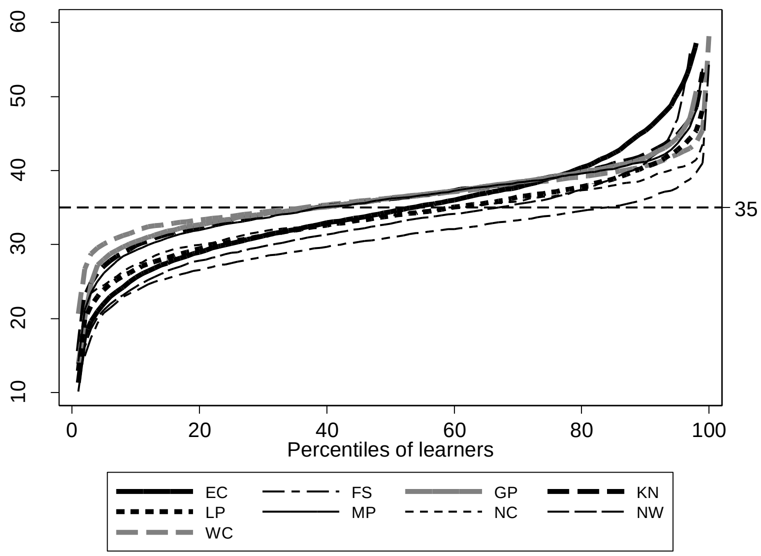
Figure 5: Distribution of raw school L/E ratio (national)



Some examples of what the above graph is saying:
- Around 15% of learners are in schools with a raw school L/E ratio exceeding 40.
- Around 20% of learners are in schools with a raw school L/E ratio below 30.

The provincial curves in the following graph indicate that learners in FS experience exceptionally low raw school L/E ratios. The case of EC is interesting. In that province, a relatively large proportion of learners experience a low L/E ratio (the EC curve is one of the lowest on the left-hand side of the graph), and a relatively large proportion of learners experience an exceptionally high L/E ratio (the EC curve is the highest on the right-hand side of the graph).

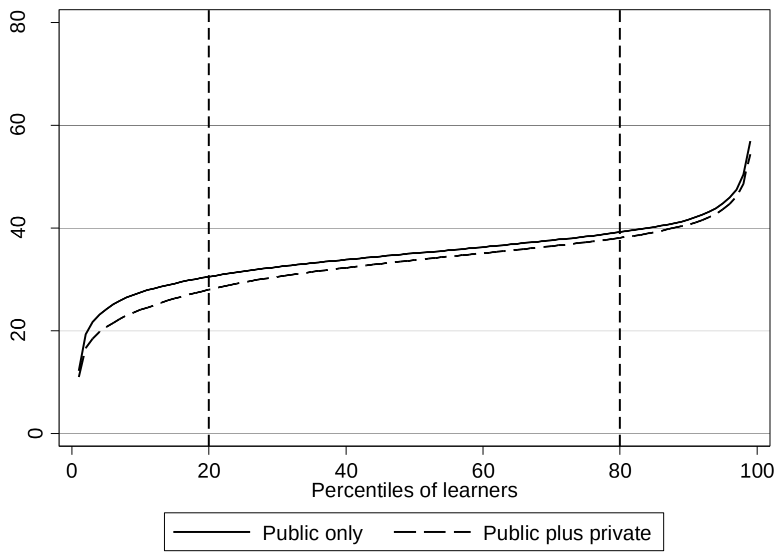
Figure 6: Distribution of raw school L/E ratio (provinces)



Some examples of what the above graph is saying:
- Around 85% of learners in FS are in schools with a raw school L/E ratio of less than 35.
- Around 45% of learners in EC in are in schools with a raw school L/E ratio exceeding 35.

The following graph indicates that the lowering of the L/E ratio brought about by the presence of privately paid educators is a stronger feature in those schools which already have fairly low L/E ratios, based on the provisioning of publicly paid educators.

Figure 7: Distribution of raw school L/E ratio: public plus private (national)



An example of what the above graph is saying: ▪ 20% of learners are in schools with a raw school L/E ratio below 30, counting only publicly employed educators, but if we count publicly and privately employed educators, then 20% of learners are in schools with a raw school L/E ratio below 28.

4.5 The distribution of 'effective school L/E ratios'

We can understand the 'effective school L/E ratio' as learners divided by the number of educators teaching full-time. In other words, this ratio takes into account the fact that in accordance with policy, some educators are not required to teach full-time. In a simulation using the *actual* distribution of educators across schools, the *actual national average* in terms of the proportion of management posts in schools, but a policy-informed simulation of the utilisation of educators *within* schools, these educators not required to teach full time come to around 21,000. Whilst the 'raw school L/E ratio' is 35.2 at the national level, the effective school L/E ratio is 37.7. In other words, taking into consideration management time in schools raises the school L/E ratio by 2.5 points.

The problem with the 'raw school L/E ratio' discussed in the previous section is that some educators, namely those in management positions, might not teach, or might teach only part-time. The raw school L/E ratio is therefore not a very precise indicator of the *average* class size in the school (the next section deals with *actual* class sizes, which is a different matter from average class sizes). For a better measure of the average class size in a school, we need to divide learners by those educators who teach full-time. This is called the 'effective school L/E ratio' in this report. We would expect this effective L/E ratio to be higher than the raw L/E ratio in schools with educators who do not teach full-time.

An important point to note is that the policy implicitly assumes that full-time teachers (and even full-time equivalent teachers, in a sense) are class teachers. Because learning time is always less than the minimum teaching time required of full-time teachers, a full-time teacher must teach during all periods in the school day. Even then, a teacher ends up not teaching the minimum required teaching time of a full-time teacher, because learning time is always shorter than this minimum. The policy does not make room for 'free periods' for teachers. This conflicts with what is commonly understood as good timetabling in the FET band. The common understanding is that FET teachers should have free periods. Strictly speaking, this is only possible within the policy parameters if learning time is spread out over a longer school day so that learners too have some free periods, or if classes are combined during certain periods. In the FET band, the assumption that full-time teachers are also class teachers can become shaky. However, in the GET band, it is a logical assumption to make, given the policies. This means that the effective school L/E ratio (at least in the GET band) can be understood as learners divided by full-time teachers, which is another way of saying learners divided by class teachers, or even learners divided by classes. This would not hold if policy provided for full-time teachers in support roles, such as remedial teaching. This is not the case currently, however.

To calculate the effective school L/E ratio that *ought to exist* in each school, it was necessary to have input data on, firstly, how many managers at different levels exist in each school and, secondly, the rules for the number of hours that managers have to teach. The objective was to use the input data to calculate how many full-time teachers and full-time equivalent teachers there were in each school, and to thereby calculate what the effective school L/E ratio should be. Section 4.7 below tackles the question of what the effective school L/E ratios *actually* are.

With regard to the first data need, there is an important gap in the Snap Survey in the sense that this dataset does not indicate the number of Deputy Principals per school, nor does it indicate what the post level of the Principal is (in section 3.3 it was indicated that Heads of Department are required to teach full-time, so information on HODs was not required). The solution pursued was to use the information on the distribution of educators across post levels in Table 9 and Table 10, and the parameters for the post level of Principals from Table 7, in order to simulate the provisioning of Principals and Deputy Principals. In order to focus both on what actually occurs, and what the policy says should occur, both the recommended distribution from Table 9 and the actual *national* distribution from Table 10 were used in separate simulations.

With regard to the second data need, the minimum weekly teaching time of Table 5 was used as a point of departure. That table provides a range of teaching times for Principals, and not exact hours per post level. Hence some assumptions had to be made about reasonable teaching times for Principals to fill in the gaps. For primary schools (taken to mean all schools with no learners in the Grades 8 to 12 range), the approach that was used combined the parameters of Table 5 applicable to Principals with the assumption that a Principal's minimum teaching time would never be greater than that applicable to a non-Principal on the same post level. For the remaining schools, those in the 'secondary/combined' category, the approach is a more or less 'linear' one (it is linear in the sense that the differences in teaching time between post levels are more or less equal). The approaches are summarised in Table 17.

Table 17: Assumed teaching load of school principals

	Primary		*Secondary/ Combined*	
Principal PL 1	85%	29h 45m	60%	21h 00m
Principal PL 2	85%	29h 45m	40%	14h 00m
Principal PL 3	60%	21h 00m	25%	8h 45m
Principal PL 4	10%	3h 30m	5%	1h 45m

In running the simulations, a full-time equivalent teacher was deemed to be obtained if the teaching time of several managers not teaching full-time came to the learner contact time prescribed for the *average* learner in the school (using parameters from Table 8). In calculating the effective school L/E ratio, E was always whole full-time teachers, never fractions of such teachers.

The next table presents the results of the simulations. 'Effective A' provides the ratios obtained when the *actual* national distribution of educators across post levels (the bottom line from Table 10) is used. This is arguably the most informative scenario (because it corresponds to the actual situation). 'Effective B' uses the *policy guidelines* for the distribution of post levels (bottom line of Table 9). 'Effective B' is thus a scenario with a particularly strong prioritisation of management time as opposed to teaching time. Both scenarios use the teaching time requirements from Table 17.

'Non-teachers' in the bottom line is the number of publicly employed educators not teaching full-time, according to the simulation. The learner-weighted raw school L/E ratios from Table 16 are repeated here for comparison purposes. Note that no privately employed educators are considered in any of the simulations.

Table 18: Averages for the 'effective school L/E ratios'

	Raw	*Effective A*	*Effective B*
EC	35.4	38.7	39.0
FS	30.6	31.8	32.2
GP	36.8	38.3	38.7
KN	36.5	39.3	39.6
LP	33.9	36.5	36.8
MP	35.9	38.0	38.4
NC	33.8	35.8	36.3
NW	33.1	35.4	35.7
WC	36.4	38.3	38.8
SA	35.2	37.7	38.0
'Non-teachers'	0	21,448	24,346

Note: All are averages across learners. The effective L/E ratios are based on a policy-informed simulation of time allocated to management and to teaching per school. Importantly, the actual number of educators per school in 2005 is used.

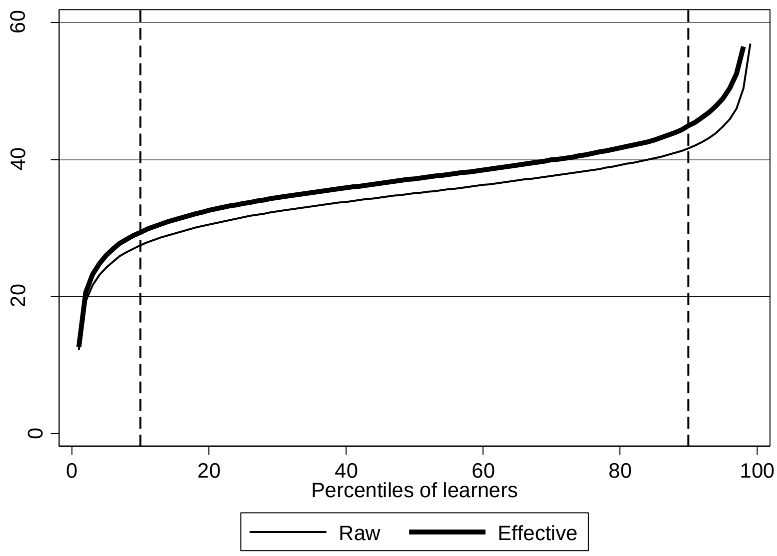
If we take into account the fact that some educators do not teach, the school L/E ratio rises by 2.3 learner points on average, from 35.2 to 37.7 (using 'Effective A'). This difference varies across provinces. The greatest difference appears in EC – the difference is over 3 learner points. It is important for this difference to be taken into account in the educator distribution system, and in the planning of educator supply. Put simply, if we want to achieve average class sizes of, say 35.0 in EC, we have to plan to provision around one educator for every 32 learners, not one educator for every 35 learners, in each school.

The two scenarios are not that different from each other, suggesting that even a rather generous accommodation of school management time in the policies does not have a particularly adverse effect on the effective school L/E ratio. In other words, if the system were to move from the current practice (represented more or less by 'Effective A') to a policy setup with more school management time, this would have a relatively small effect on average class sizes.

One way of understanding what the 'Effective A' scenario means for schools is to consider the proportion of schools, and the proportion of learners in those schools, where the raw school L/E ratio and the effective school L/E ratio are equal, in other words all publicly employed educators are expected to teach full-time. The scenario 'Effective A' implies that in 16% of schools, accommodating 2% of learners, the two ratios would be equal. In all other schools, there would be at least one manager not teaching full-time.

Figure 8 illustrates the distribution across learners of the raw school L/E ratio and the effective school L/E ratio using the 'Effective A' scenario. It is clear that a difference between the two ratios is something experienced by most learners in the system.

Figure 8: Effective school L/E ratio (national)



An example of what the above graph is saying:

- For 90% of learners, the raw school L/E ratio (all learners divided by publicly employed educators) is less than 40. For these learners, the effective school L/E ratio (all learners divided by publicly employed educators who teach full-time) is less than 43 (based on a policy-informed simulation of how time is split between teaching and management in each school).

4.6 The distribution of 'forced multi-grade teaching'

Around 9% of learners in the country are in schools where some multi-grade teaching takes place. We can assume that the proportion of learners who at some point in their lives would be taught in a multi-grade setting would be somewhat higher than 9%. Using certain assumptions, one can simulate the proportion of learners who in any year would be in a multi-grade class. A simulation explained here resulted in a proportion of 4.6% (this figure is supported by the Annual Survey 'reality check' appearing in section 4.7). This figure varies greatly between provinces, from 9.5% in EC to 0.7% in GP. This has implications for, amongst other things, the type of training that managers and teachers need. With regard to Principal training, it is important to note that although only around 4.6% of *learners* are at any point in time in multi-grade classes, a full 30% of *schools* are forced to practice multi-grade teaching. Clearly it is important for a large proportion of Principals in the country to understand how to manage this phenomenon.

Multi-grade teaching need not be regarded as an obstacle to effective teaching and learning. However, it is important that schools and educators be skilled in delivering this kind of service (DoE, 2005: 46). Multi-grade teaching and learning receives very limited attention in the country's education policies and monitoring systems, despite the fact that (as will be shown below) almost a third of schools in the country have multi-grade classes. The focus here is on the extent of multi-grade teaching in the schooling system.

If there are fewer educators in a school than there are grade groups, multi-grade teaching becomes inevitable. The first column in Table 19 indicates the proportion of schools which are forced to do multi-grade teaching. Nationally, almost a third of schools find themselves faced with this challenge. The challenge is greatest in EC and FS.

Table 19: Averages for 'forced multi-grade teaching'

	Proportion of schools forced to do multi-grade teaching	Proportion of all learners in these schools	Proportion of learners forced to be in a multi-grade class
EC	42.5%	20.3%	9.5%
FS	58.5%	6.2%	5.0%
GP	5.2%	1.5%	0.7%
KN	24.6%	8.4%	4.4%
LP	19.4%	6.0%	3.2%
MP	33.6%	6.9%	5.0%
NC	35.9%	8.0%	4.6%
NW	29.6%	7.4%	4.5%
WC	27.3%	5.4%	3.2%
SA	30.6%	8.6%	4.6%

Note: The statistics in the last column are based on a simulation of the within-school allocation of teachers.

The second column indicates the proportion of learners who find themselves in schools which are forced to do multi-grade teaching in some grade (not necessarily the grade of the learners in question). In this column, EC stands out has facing a particularly great challenge. It is noteworthy that although an exceptionally high proportion of *schools* in FS are forced to do multi-grade teaching, the fact that FS has so many small schools means that in terms of the proportion of *learners* in the multi-grade schools, FS is below the national average. Put differently, a high proportion of Principals in FS need to have the skills required to manage a school with multi-grade classes, but a relatively low proportion of learners and teachers actually have to deal with this phenomenon. One can see how understanding these patterns of multi-grade teaching in the various provinces is important for the design of capacity building programmes.

The second column provides a rough sense of the proportion of learners who at some point in their school life will have to share a class with learners from other grades. (It is a rough sense, however, because the fact that learners may move from primary schools that do have multi-grade teaching to secondary schools that do not, means that the proportion of learners exposed to multi-grade teaching at some point in their school career would in fact be higher than what is indicated by the second column.) The third column indicates the proportion of learners who were in multi-grade classes in the 2004-2005 period (the period for which the data applies).

The statistics in column three were obtained through a simulation process that built on the simulations applied to obtain the effective school L/E ratios. The simulation methodology is explained here. Firstly, the full-time teachers (including equivalents) obtained in the 'Effective A' scenario from the previous section were taken as the applicable number of full-time teachers in each school (even if one had taken all educators, the multi-grade simulation would not have been very different, as in the small schools that are forced to do multi-grade teaching, the Principal is generally required to teach full-time according the policy guidelines). The number of teachers was then compared to the number of learners per grade. The following is an example of the data for one school:

Table 20: Simulating multi-grade teaching

	Teachers	*Learners*							
		Gr 1	*Gr 2*	*Gr 3*	*Gr 4*	*Gr 5*	*Gr 6*	*Gr 7*	*Total*
Before	3	5	11	7	10	7	0	0	0
Approach 1	3	0	16	0	17	7	0	0	0
Approach 2	3	0	23	0	10	7	0	0	0

The simulation involved first assessing how many grades would need to move into other grades. As there are five grades and three teachers in this school, two grades must be 'moved'. The grade with the lowest enrolment is found. This is Grade 1. Grade 1 learners are placed in the closest grade which has learners, in this case Grade 2. Next the smallest remaining grade is found. This is Grade 3 (it could also have been Grade 5, but the simulation moves from left to right). The grades 'next to' Grade 3 are inspected to see which has the lowest enrolment. Grade 4 has 10 learners and Grade 3 now has 16 learners (the combination of the original Grades 1 and 2). Hence the Grade 3 learners are 'moved' to Grade 4, resulting in 17 learners in 'Grade 4'. Had there been no grades with learners 'next to' Grade 3, the next step would have been to inspect grades 'two away' from Grade 3. The end result is a situation where only seven learners, the ones in Grade 5, are not in a multi-grade setting. In other words 33 of 40 learners are in multi-grade classes. The solution is represented as 'Approach 1' in Table 20. In this approach, the emphasis is on keeping enrolment numbers in *each* class as low as possible. Another approach is possible where the emphasis is rather on keeping the total number of learners who are in multi-grade classes as low as possible. That approach would result in the figures in 'Approach 2'. Here only 23 of 40 learners are in a multi-grade class. Only 'Approach 1' was simulated, and the results in the third column of Table 19 indicate that 4.5% of learners would be in multi-grade setting. It should be emphasised that as this is the result of simulation based on certain assumptions, the actual percentage of learners in a multi-grade setting could be a bit higher or a bit lower than what is shown in Table 19. It could be somewhat lower, if Approach 2 were followed by all schools. Or other approaches could result in higher percentages, though never more than the 8.4% at the national level indicated in the middle column. (The analysis of Annual Survey data in the next section arrives at a figure of 4.4%, very close to the simulation-based figure quoted here.)

The way educator posts are distributed to schools has a direct impact on the proportion of learners forced to be in multi-grade classes. It is useful for this information to be explicit in a distribution model, as this can provide important information for the planning of in-service training of teachers, amongst other things.

The simulations described here examine what the likely management behaviour with respect to the merging of grades is at the school level given a number of educators. Another important exercise, not discussed here, is calculating the minimum number of educators a school would require given certain criteria around what is an acceptable level of grade-merging. Specifically, it can probably be taken as a given that it is unacceptable from a curriculum delivery point of view to merge learners from different curriculum phases. Currently, many schools are forced to do precisely this. There are two possible solutions to this problem: provide more educators, in line with the number of phases being offered, or merge small schools so that unsustainable enrolment patterns are eliminated. With respect to this last point, the following table is instructive.

Table 21: Schools with small enrolments per GET phase

	Foundation		Intermediate		Senior	
	All	*EC*	*All*	*EC*	*All*	*EC*
1 to 5 learners	280	65	594	125	667	131
6 to 10 learners	565	105	810	163	649	120
11 to 20 learners	1,036	192	1,042	213	1,105	269
21 to 30 learners	812	169	818	179	1,130	248
31 learners and more	16,084	4,482	15,833	4,252	16,512	3,522

Many phases in many schools in the country seem unsustainable. Whilst EC accounts for a substantial share of the phases with very low enrolments in the country, it by no means accounts for the bulk of this problem.

4.7 The distribution of 'class L/E ratios'

On the basis of a simulation that uses the existing distribution of educators across schools, and that assumes an optimal utilisation of educators within each school, it is concluded that two-thirds of learners are in classes with 40 learners or fewer, and that 10% of learners are in classes with more than 48 learners. However, a rather different picture emerges if Annual Survey data is used to obtain actual class sizes prevailing in schools. This reality check reveals that only 40% of learners are in classes with fewer than 40 learners, and that 10% of learners are in classes exceeding 69 learners. The phenomenon of very large classes appears to be especially prevalent in more rural provinces. Importantly, a large part of the problem is that educators allocated to *schools* by the PED, are then not allocated to *classes* by school management. Even in primary schools, around 18% of publicly employed educators based in the school are not allocated to classes as class teachers. Policy implies that this figure should be closer to 8%. It is difficult to gauge from the data what the 18% figure means for schools in practical terms, but it is seems clear that teacher utilisation is sub-optimal. Whilst it is logical to expect this problem to be related to the availability of classrooms (teachers without classrooms would be under-utilised), the data indicate that the under-utilisation problem is more or less equally experienced by schools with and without classroom shortfalls, suggesting inadequacies in school management. The TIMSS 2003 dataset confirms the pattern found in the Annual Survey reality check. Specifically, TIMSS shows that over 10% of South Africa's Grade 8 learners are in classes with more than 60 learners. Moreover, it shows that even in comparison to developing countries, South Africa's class sizes are high.

What is described as 'class L/E ratio' here is what is often referred to as 'class size'. What this means is the number of learners in the actual class that the learner is in. This indicator is of crucial importance to understanding the conditions under which learning and teaching takes place. Whilst the effective school L/E ratio discussed in the previous section tells us what the *average* class size is in a school, this average would mask the fact some learners would be in classes of above average size, whilst others would be in classes of below average size.

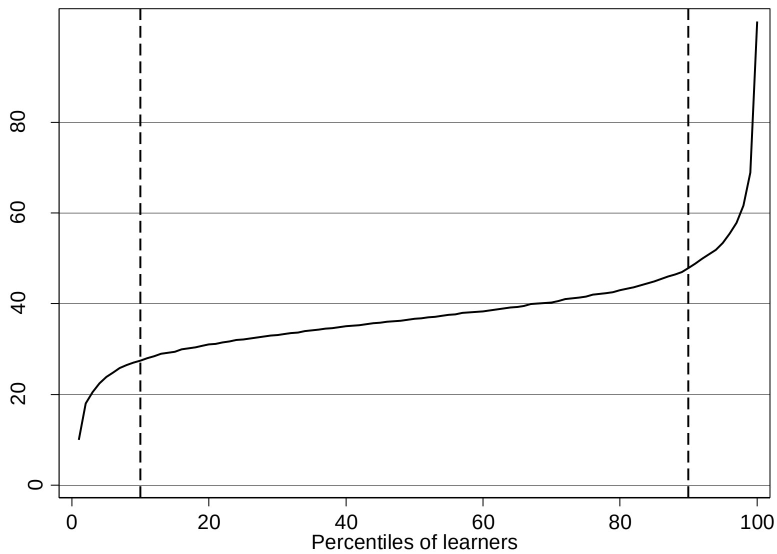
The Snap Survey does not include information on which educators teach which grades in the school. It is thus not possible to gauge from the Snap Survey data what the average class size per grade is in any simple way. The Annual Survey of Schools (ASS), on the other hand, comes very close to providing data on 'class L/E ratios', though even that dataset does not tell the full story. The ASS provides number of classes in each grade (but only where there is no multi-grade teaching), and the number of learners in each grade. Dividing learners by number of classes provides the grade average for the class L/E ratio. This is not exactly the class L/E ratio, because 100 learners in a grade may not be divided into two equal classes of 50. There may be one class of 40 and one of 60. But the ASS nevertheless provides a useful close approximation of the class sizes experienced by learners.

The approach taken here was to simulate likely class sizes, assuming the correct application of the relevant policies, using the Snap Survey data, and then to perform a reality check using the ASS data. The two results, as will be shown, are very different. Both the simulation and the reality check are important in themselves. The former shows what class sizes are possible, at least in theory, given the resources the system has, whilst the latter tells us what learners and teachers actually experience.

The results using the Snap Survey data come out of the same simulation that was run to obtain the multi-grade teaching statistics discussed in the previous section. After grades had been merged, the simulation found the number of full-time teachers (plus full-time equivalents obtained from the managers) that exceeded the number of grade groups after merging. This number of excess teachers, if any, were then distributed across the grades in such a way that the maximum class size within each school was reduced as far as possible. (Class size was taken to be enrolment by grade divided by full-time teachers assigned by the model to each grade.)

Figure 9 illustrates the distribution of class L/E ratios obtained from the simulation. The distribution is not that different from the effective L/E ratio of Figure 8. Clearly, classes exceeding 40 learners are likely to be common in the system. The simulation revealed around one-third of all learners would be in such classes.

Figure 9: Simulated class L/E ratio (national)

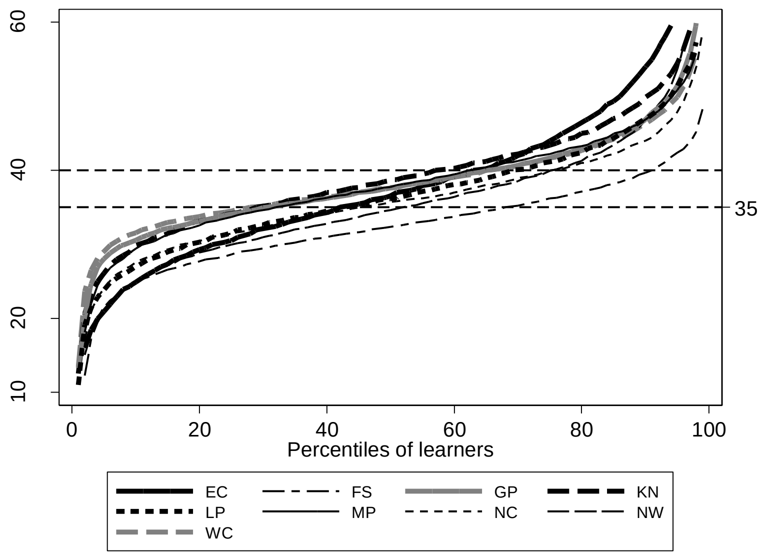


Some examples of what the above graph is saying (this graph is based on a simulation of the within-school utilisation of existing educators): ▪ Around 32% of learners find themselves in classes with more than 40 learners, according to the simulation. ▪ Around 10% of learners find themselves in classes with more than 48 learners.

The provincial curves for the class L/E ratio, provided in the next graph, reveal some interesting inter-provincial differences. Large classes can be expected to be more common in EC. In this province, the simulation shows that close to 10% of learners would be in classes of almost 60 learners. This is the cost of having relatively low class L/E ratios at the low end in

EC (the EC curve is the lowest for all provinces on the left-hand side of the graph). In contrast, KN has a more balanced situation, with fewer very small classes, but also fewer very large classes. The situation in EC would be difficult to change, given the structural peculiarities of this province relating to grade group size discussed in section 4.3.

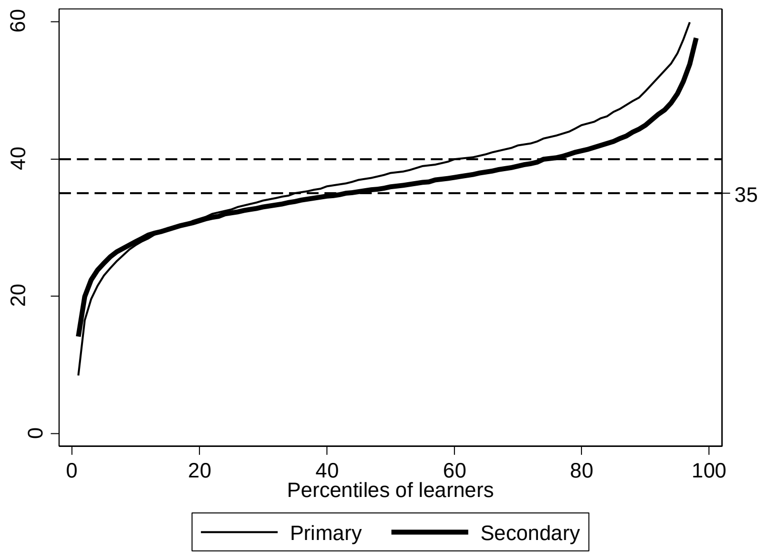
Figure 10: Simulated class L/E ratio (provinces)



Some examples of what the above graph is saying (this graph is based on a simulation of the within-school utilisation of existing educators): ▪ Just under 10% of learners in EC are in classes exceeding 60 learners, according to the simulation. ▪ Only 10% of learners in FS are in classes exceeding 40 learners, whilst the figure is around 35% for WC and GP.

The following graph provides the results of the simulation according to the level of the grade. Grades 1 to 7 tend to have classes around 4 points larger than Grades 8 to 12. This is roughly in line with the differential implied by the benchmark often quoted (but not set in policy) of 40 learners per educator in secondary grades and 35 learners per educator in primary grades. It is the general pattern internationally to have higher L/E ratios at the primary level than at the secondary level, though the differential between the two varies from region to region, as shown in Table 22. Given the generally high L/E ratios in South Africa, the differential between South Africa's primary and secondary ratios are relatively low by international standards. The two regions with L/E ratios comparable to our own, namely South and West Asia and Sub-Saharan Africa, have differentials that are much larger than ours. (Whilst it seems admissible to use the UNESCO figures to gauge the differential between the primary and secondary levels, caution must be exercised in any other kind of analysis. Specifically, the UNESCO figures are all learners divided by all educators, and are hence not an indication of, for instance, the effective school L/E ratio.)

Figure 11: Simulated class L/E ratio: primary and secondary (national)



Some examples of what the above graph is saying (this graph is based on a simulation of the within-school utilisation of existing educators):

- At the primary level, just under 40% of learners are in classes exceeding 40 learners, according to the simulation.
- At the secondary level, just over half of learners are in classes with more than 35 learners.

Table 22: Primary and secondary L/E ratios across world regions

	Primary	Secondary	Difference
Arab States	22	18	4
Central and Eastern Europe	17	13	4
Central Asia	19	12	7
East Asia and the Pacific	25	20	5
Latin America and the Caribbean	21	16	5
North America and Western Europe	14	12	2
South and West Asia	40	31	9
Sub-Saharan Africa	44	24	20

Source: UNESCO, 2005.

The following table provides a comparison of some key ratios that have been examined so far, and one that has not received attention. Column A (the indicator that has not received attention yet) represents Grades 1 to 12 learners, divided by all publicly employed educators in public ordinary schools in those schools. This is a commonly used indicator in the planning process, but there are limitations to what it can tell us. One might think this would yield the same result as the average across learners of the 'raw school L/E ratio' (column B), but it does not. Unless educators are completely equitably distributed across schools, column B will be greater than column A (if the distribution were equitable, the values would be the same). The Column A figures are commonly used to gauge inter-provincial equity, partly because they are easy to calculate, and partly because the division of revenue process, by making total enrolment and school-age population key drivers of education funding, make this L/E ratio an important one (the division of revenue process does not take into account special treatment for small schools, or the extent of small schools in a province, though insofar as small schools are a phenomenon of the poorer provinces, and there is a cross-sectoral pro-poor element in the formula, there is some indirect recognition of the need). For instance, Treasury's *Intergovernmental Fiscal Review* and the 2005 *Provincial Budgets and Expenditure Review* place considerable emphasis on the Column A indicator. The 'C/A' column indicates the gap between the simple Column A figure and the average class sizes (or effective school L/E ratio) of schools. This gap is largest in EC, as one may expect, given the structural issues in this province. What may seem surprising is that the gap should be so large in NW. Whilst the province funds an educator for every 31.3 learners (this is the second-most generous figure of the nine provinces), the effective school L/E ratio statistic, whilst below the national average, is nevertheless high relative to the investment. The reason behind this gap in NW would not be structural - Figure 3 indicated that grade group sizes in NW are not exceptionally small. The answer is to be found in Figure 6, which showed that the provisioning to around one half of the schooling system is particularly generous in comparison to other provinces, whilst large classes are a feature in the other half of the system. Whilst this may not be a problem (especially given that even classes at the 90th percentile are below the national average), this inequity (and possible inefficiency) in NW is worth noting.

Table 23: Relationship between aggregates and class L/E ratios

	Province-level calculation	School-level calculation		Class-level calculation		
	A Learners/ all school educators	B Learners/ all school educators (raw school L/E ratio)	C Learners/ full-time teachers (effective school L/E ratio)	D Class size at 90th percentile	C/A	D/A
EC	33.1	35.4	38.7	54.0	1.17	1.63
FS	29.1	30.6	31.8	39.7	1.09	1.37
GP	35.5	36.8	38.3	46.8	1.08	1.32
KN	35.4	36.5	39.3	49.9	1.11	1.41
LP	32.7	33.9	36.5	47.0	1.12	1.44
MP	34.9	35.9	38.0	46.8	1.09	1.34
NC	32.6	33.8	35.8	44.0	1.10	1.35
NW	31.3	33.1	35.4	46.8	1.13	1.50
WC	35.9	36.4	38.3	46.3	1.07	1.29
SA	33.6	35.2	37.7	48.0	1.12	1.43

Note: The statistics in columns B and C are averages across learners. Statistics in columns C and D are based on a policy-informed simulation of within-school utilisation of publicly employed educators.

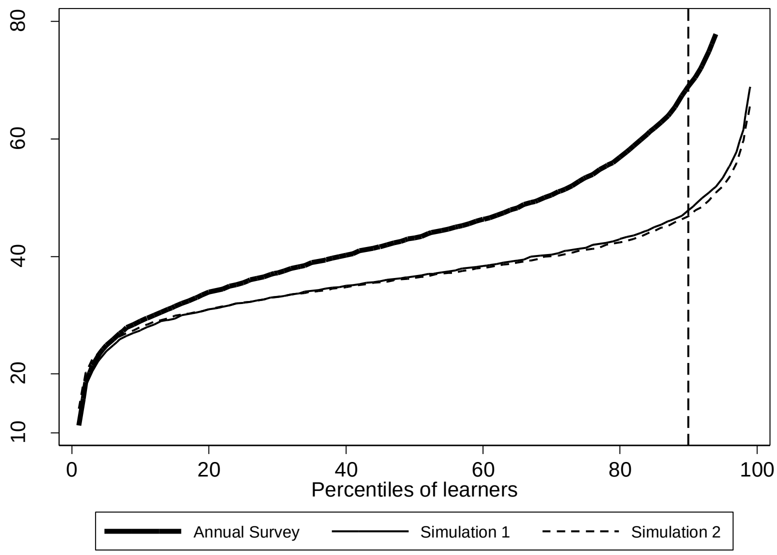
We now turn the reality check on class size using the Annual Survey of Schools data. The 2003 ASS data was used, as this was the last year for which relatively well normalised data from the provinces were available. It should be pointed out that the ASS dataset is much larger than the Snap Survey dataset, and has been subject to less rigorous cleaning and analysis. There are also more gaps in this dataset than in the Snap Survey dataset. For this reason, the analysis that follows proceeds with caution.

In the ASS, the Principal is asked to specify the number of classes per grade, where there is no multi-grade teaching. The total number of schools with this number of classes data is 17,067 (this includes both public and independent schools). Enrolment numbers are requested in various parts of the ASS booklet. The enrolment by age numbers were used here, as they tallied well with reported enrolment totals per province. Around 4.4% of Grades 1 to 12 learners in the 17,067 schools did not have the number of classes specified for their grade. If the ASS booklet were filled in correctly, this would indicate that 4.4% of learners are being taught in multi-grade classes. Notably, this figure is virtually equal to the 4.6% of learners in multi-grade classes obtained from the simulation and reported in Table 19. It would seem as if in this regard the simulation approximates the actual situation closely.

To perform the reality check, only those schools from the set of 17,067 schools which also appeared in the Snap Survey dataset (the one used in the analysis of the previous sections) were used (the national EMIS numbers were used to identify schools). This was partly done to ensure that no independent schools were considered. The operation resulted in 15,231 schools from the ASS dataset. The corresponding 15,231 schools from the Snap Survey dataset were isolated for the comparison that follows. Moreover, learners who were in multi-grade settings in the Snap Survey dataset (according to the simulation) were removed from the 15,231 schools, in order to make the Snap Survey data as equivalent as possible to the ASS data.

The following graph illustrates the simulated Snap Survey distribution of class sizes, and the ASS distribution of class sizes. The graph represents single-grade classes only. There are two Snap Survey curves. Simulation 1 is the national curve from Figure 9 that takes into consideration all 25,627 schools from the Snap Survey. Simulation 2 is the distribution of class L/E ratios for the sub-set of 15,231 schools with multi-grade classes removed. The fact that the two Snap Survey curves should be so close to each other suggests strongly that the 15,231 schools are representative of public ordinary schools in general. In other words, the fact that the reality check misses out on some 10,000 schools does not appear to influence the results in a major way.

Figure 12: Reality check against Annual Survey (national)



Some examples of what the above graph is saying:

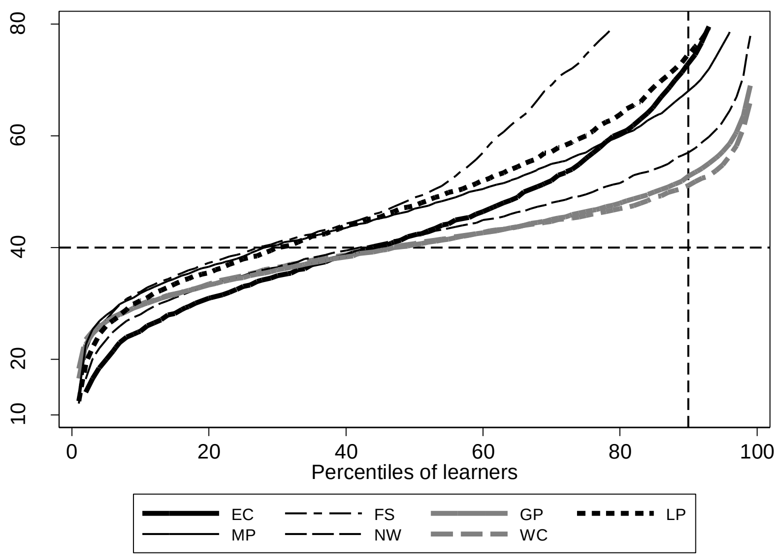
- According to the simulation using the Snap Survey data, just over 10% of learners are in classes with more than 45 learners.
- According to the ASS data, around 40% of learners are in classes with more than 45 learners, and 10% of learners are in classes with more than 69 learners.

The difference between the ASS and Snap Survey results is huge. At the far right-hand side of the graph, above the 80^{th} percentile, the ASS yields classes that are greater than the simulated classes by as much as twenty learners. Put differently, the ASS is saying that there are twenty more learners in each class. The ASS curve using only GET learners (learners in Grades 1 to 9) was constructed, and this yielded an almost identical curve to the ASS curve in the above graph. The phenomenon of very large classes would seem to be a reality across both bands, GET and FET, of the schooling system.

In one important sense, the Snap Survey and ASS datasets used for the above graphs are not comparable, but if this were corrected, we would expect an even *larger* difference between the two. Specifically, by dividing learners per grade by reported number of classes per grade in the case of the ASS, we are not filtering out the effect of privately paid educators in public schools. Teachers employed by the SGB would increase the number of classes per grade, and hence decrease the class L/E ratio, in a number of schools, particularly more historically advantaged schools. If we were to undertake the necessary correction (this is impossible given the structure of the questionnaire), the ASS curve in the previous graph would move up, though this is likely to happen more on the left-hand side of the graph, where the historically advantaged learners are situated, than on the right-hand side.

The next graph indicates that the phenomenon plays itself out rather differently across the different provinces.

Figure 13: Reality check against Annual Survey (provinces)



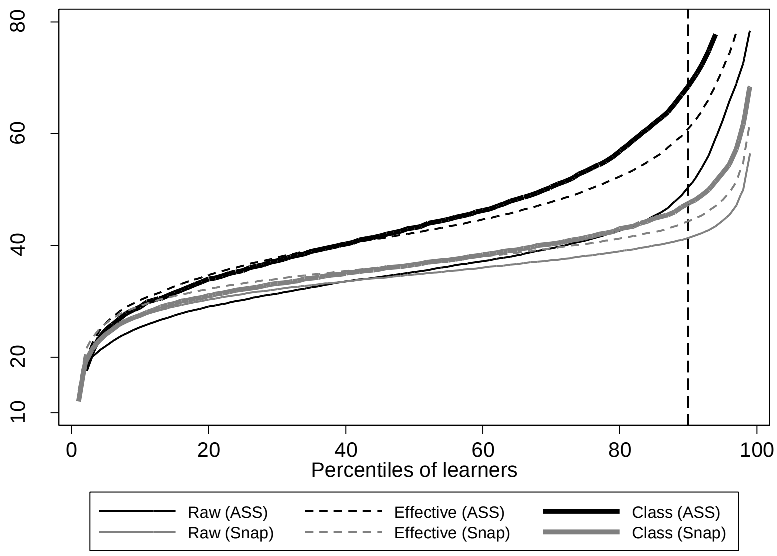
Some examples of what the above graph is saying: ▪ In GP and WC, around 10% of learners are in classes with more than 52 learners. ▪ In EC and LP, around 10% of learners are in classes with more than 72 learners.

There were no schools from KN or NC in the set of 15,231 schools, hence there are no curves for those two provinces. The two highly urbanised provinces, GP and WC, have the smallest problem with respect to large class sizes. The graph suggests that very large classes are to a large degree a phenomenon of the more rural provinces. NW is relatively well-off in this regard. The provinces EC, LP and MP carry a large part of the burden. The FS curve is so very different from the simulation (in the simulation, FS had the smallest classes at the 90th percentile, according to Table 23) that one might conclude that the number of classes per grade in the ASS dataset is systematically under-stated for this province.

To understand the reality better, we need to compare the distributions of three indicators for each of the two datasets: the raw school L/E ratio, the effective school L/E ratio and class L/E ratio. This comparison was undertaken after all schools with any multi-grade teaching in the ASS had been excluded, as the presence of multi-grade teaching in the ASS would make the effective school L/E ratio impossible to obtain, given gaps in the dataset (there was no reliable data for the number of multi-grade classes per school question). Moreover, schools without data on the number of educators in the ASS had to be removed (this measure excluded all schools in GP and WC). This reduced the 15,231 schools to 11,724 schools. With regard to the Snap Survey simulation, all learners in the corresponding 11,724 schools were counted, whether the simulation put them in multi-grade classes or single-grade classes.

In the following graph, the raw school L/E ratio for both datasets is all learners per school (even learners in classes not classified as Grades 1 to 12, for instance Grade R learners) in the 11,724 schools divided by all publicly employed educators in those schools. In the case of the ASS, the effective school L/E ratio is the sum of Grades 1 to 12 learners divided by the sum of all the classes in the school. In the case of the Snap Survey data, effective school L/E ratios appearing in Figure 8 were used (for the 11,724 schools only).

Figure 14: Effective and raw school L/E ratios in Annual Survey



Some examples of what the above graph is saying:

- The 2003 Annual Survey data on classes per grade and learner numbers indicates that in the 11,724 selected schools 10% of learners experience an effective school L/E ratio of more than 61.
- The simulation produced for this analysis, based on the Snap Surveys of 2004 and 2005 for the 11,724 schools, indicates that 10% of learners experience an effective school L/E ratio of more than 44.

The graph sheds some light on why there are so many learners in large classes according to the ASS. The raw school L/E ratios follow different curves. Whilst both the Snap Survey and ASS data are telling us that around 50% of learners experience a raw school L/E ratio of over 35, the ASS curve rises above the corresponding Snap Survey curve on the right-hand side. Some of the explanation for the exceptionally large class sizes in the ASS data can be traced back to a less equal distribution of raw school L/E ratios in 2003 than in 2005. This, in turn, might be linked to a better implementation of the teacher distribution policy, or simply to demographic shifts with respect to learners.

A much larger part of the explanation lies in the difference between the raw school L/E ratio and the effective school L/E ratio in the ASS. Whilst in the Snap Survey simulation, the fact that some managers do not teach raises the L/E ratio by around two learners, in the ASS data the difference is often close to ten. What does this mean in practical terms? It means that according to the ASS, a larger number of publicly employed educators than one would expect are attached to schools, but are not attached to classes. In other words, they do not increase the number of classes in a school, and thus do not assist in reducing class sizes. It might be useful to gain a clearer sense of the magnitudes involved. If we take the 90^{th} percentile from the above graph, we find that the raw school L/E ratio is around 50, whilst the effective ratio is around 61 (using the ASS curves). In a school of 800 learners, this implies that there are 16 publicly employed educators, and that 13 of these are attached permanently to classes. Three educators are thus not attached to classes. The simulation from section 4.5 indicates that a school of this magnitude should have 15 full-time teachers – typically the Principal and the Deputy Principal would together be in a position to take one class. In other words, both managers would manage part-time and both would teach part-time. This begs the question of why three educators, and not one, would not be taking classes. One obvious explanation would be that there are not enough physical classrooms in the school, and that it has been decided at the school that it is preferable to have 13 classes which are all indoors, whilst allowing for a certain degree of inefficiency in the utilisation of educators, than to have a couple of classes outdoors with a more efficient utilisation of educators. We cannot easily conclude that either of the two options is better for the overall quality of education at the school. Learning indoors in a larger class may well be better than having some learning occurring under a tree, with smaller classes. Reasons other than the availability of physical infrastructure at the school that might explain the under-utilisation of teachers would include high morbidity amongst some teachers, more time spent on school management than what is required in the policy, and simple abuse of the system, whereby educators work less than what is required by the policy because they know they face no negative consequences.

A key figure relating to the discussion above is the proportion of publicly employed educators based in schools who are not class teachers. Table 18 indicated that all publicly employed educators minus all publicly employed full-time educators was 21,448 educators. Roughly, this is the number of full-time managers (strictly speaking, we should say full-time *equivalent* managers, because in a school where, say, the Principal and the Deputy Principal together put in the hours for a full-time equivalent teacher, there would be one full-time equivalent manager, not two). This figure of 21,448 is 6% of all publicly employed educators reported in Table 12. The ASS data on the 11,724 schools, on the other hand, indicates that this statistic is not 6%, but 23%. In other words, around 23% of educators in schools are not class teachers. Put differently, 23% of publicly employed educators are not accounted for in the statistic relating to the number of classes per grade. By any standards, this seems like a high percentage. We shall call this statistic the *p* value here. Importantly, this statistic does not necessarily indicate that X% of educators do not teach. Educators in a school may be sharing classes in such a way that everyone gets to do some teaching. However, the statistic does indicate that X% of the teaching time that could be offered in the form of learner contact time (if all educators in the school taught for the whole school day), is not.

It is possible to use the ASS data to examine whether the Grade R data problem is affecting the value of *p*. (In section 4.2 it was explained that some publicly employed educators may be employed to teach Grade R, despite this being a departure from White Paper 5.) It is also possible to examine to what extent infrastructure problems, as opposed to other problems, are pushing up *p*. Schools offering FET can furthermore be isolated to examine whether subject teaching is affecting the statistic. With regard to this issue, it should be emphasised that the policy does not allow for subject teachers *who teach below a full-time level.* The policy parameters presented in section 3 imply that only Principals and Deputy Principals can teach below a full-time level. Implicitly, then, the policy parameters require subject teaching to take place by full-time teachers. For instance, a teacher specialising in mathematics across many classes would presumably still be assigned a class if the within-school allocation is optimal, and would swap periods with other teachers in the school in such a way that optimal utilisation were made of her mathematics specialisation. Nevertheless, it is still feasible that the policy may be interpreted differently at the FET band.

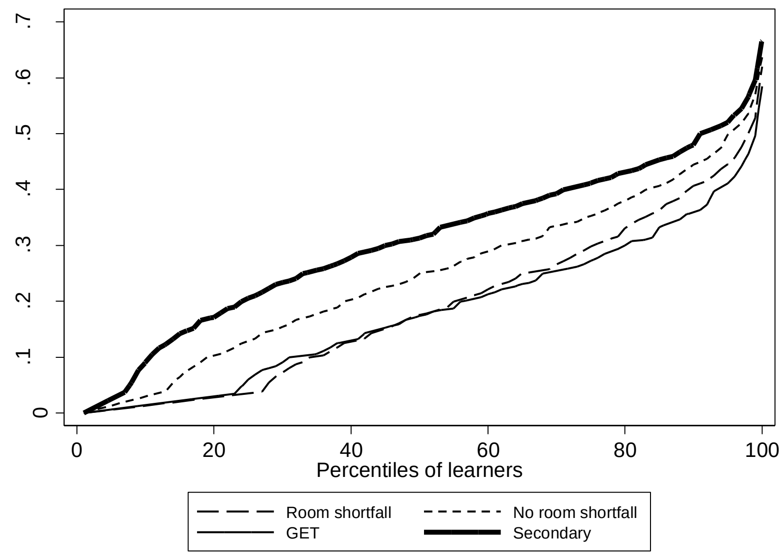
The following table indicates what the value of *p* is if certain categories of schools are extracted from the set of 11,724 schools used for Figure 14. The statistic is calculated as follows. For each school, the difference between the number of publicly employed educators and the number of reported classes is found. If there are more classes than educators in a school, the difference is set to zero (this situation could arise where schools use privately employed educators to teach classes). The statistic for each school is added, and the sum is divided by the total number of publicly employed educators based at schools. It should be kept in mind that Table 24 refers only to those ASS schools where there is no multi-grade teaching. The table indicates that excluding schools with any enrolment in grades other than Grades 1 to 12 in fact increases the value of *p*, from 22.9% to 24.0%, so clearly the 23% referred to earlier is not high due to some Grade R data anomaly. One would expect the value of *p* to be higher in schools with a classroom shortfall than in schools with no classroom shortfall. It is puzzling that this is not the case in the ASS data. Whilst 19.5% of full-time teachers are not class teachers in schools *with* a classroom shortfall, this figure is 25.7% in schools *without* a classroom shortfall. However, we could be dealing with mixed effects, for instance schools with a worse classroom shortage could be primary schools, where the value of *p* tends to be lower, as the last two lines of the table show. Perhaps the only hard conclusion that can be drawn from Table 24 is that schools offering FET have a substantially higher *p* value than schools which do not. This might indicate that educators in schools with FET are teaching below the required workload level. However, it could also be an indication that 'class' is accounted for differently at the FET level in the ASS.

Table 24: Proportion of educators who are not class teachers

Criterion	Schools	Expected proportion (based on simulation)	Actual proportion (based on ASS)
No multi-grade classes	11,724	6.6%	22.9%
No grades outside Gr 1 to 12 range	8,414	6.6%	24.0%
With classroom shortage	2,599	6.9%	19.5%
Without classroom shortage	5,815	6.5%	25.7%
GET – no Grades 10 to 12 learners	5,520	7.5%	18.1%
Secondary – no Grades 1 to 7 learners	2,718	5.5%	32.0%

Much of the foregoing analysis has pointed to the danger of looking only at averages and aggregate figures. The next graph displays the distributions of the four last ASS statistics from the previous table. Clearly, the *p* values that apply in schools vary greatly.

Figure 15: Distribution of proportion of educators who are not class teachers (p)



An example of what the above graph is saying:

- 20% of learners in schools offering only GET grades find that over 30% of the educators employed at the school are not class teachers, for one or another reason.

A regression analysis will allow us to disentangle some of the mixed effects referred to. Such an analysis was run on the data, using as a point of departure the following simple identity:

$$p = \frac{M}{T} + \frac{\max(0, F - R)}{T}$$

In this equation, the *p* value of a school is the proportion of all educators (*T*) who are managers (*M*), plus the proportion of all educators who are full-time teachers (*F*) yet do not have classrooms (*R*) in which to teach. Obviously, if there are enough classrooms in the school, then the second term becomes zero. The equation reflects a logical assumption relating to the proportion of educators one would expect not to be class teachers. We can simplify the equation as follows:

$$p = m + f$$

For the regression analysis, some additional explanatory variables, apart from *m* and *f*, were added, specifically a dummy indicating whether there was any full-time manager in the school at all (this would be zero if the Principal was required to teach full-time), dummies for the provinces for which data was available, and a dummy for the offering of FET. Number of full-time managers per school was determined on the basis of the ASS data using a similar policy-driven approach to the one used in the simulation of section 4.5. Total number of educators (*T*) included privately paid educators (to make the above equation complete), and number of classes reported in the ASS was taken to be full-time teachers (*F*). For classrooms (*R*) a mix of the 2004 Annual Survey and the 2000 School Register of Needs was used (see section 4.2). The number of schools included in the analysis was 6,826, and this was determined by data availability.

Table 25: Determinants of proportion of educators who are not class teachers (p)

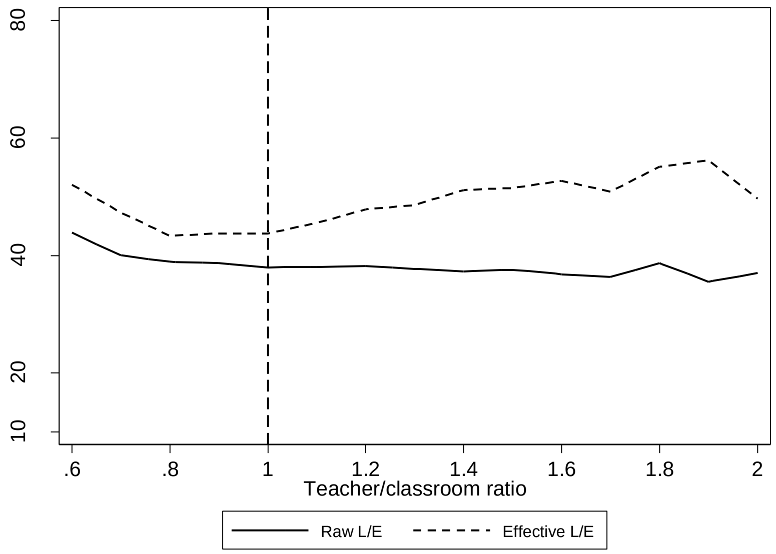
Explanatory variable	Coefficient	t statistic	95% confidence interval	
Having a full-time Principal	0.200	19.1	0.179	0.220
Managers over all educators (*m*)	-1.146	-31.2	-1.218	-1.074
Classroom shortfall over all educators (*f*)	-0.109	-12.8	-0.125	-0.092
Being in EC	-0.048	-11.2	-0.056	-0.040
Being in FS	-0.101	-14.6	-0.114	-0.087
Being in NW	-0.034	-6.7	-0.044	-0.024
Being in MP	-0.059	-10.2	-0.071	-0.048
Having FET band	0.104	30.2	0.097	0.111
Intercept	0.147	14.1	0.126	0.167

R^2 = 0.333. School records were unweighted. The default province is LP (for the other four provinces there was insufficient data).

The model predicts that a school with 800 learners and 22 educators would keep 8 educators from having their own classes, in other words there would be 14 classes with an average class L/E ratio of 57. This would be the case for a school with no classroom shortfall, which is offering FET, and is in EC or MP. If the school does not offer FET, the number of educators not assigned to classes drops from 8 to 5, which is still a higher number than policy would suggest. If the enrolment and educator establishment of the school increases by a factor of 1.5, the number of educators not taking classes increases by a factor greater than 1.5 (the explanatory variables that would change are *m* and *f*). In other words, the larger the school, the larger the *p* value. The provinces NW and LP would systematically have a higher *p* value than EC or MP according to the regression model. What is particularly striking is that the classroom shortfall as a proportion of all educators carries a *negative* coefficient. We would expect this ratio to be positively correlated with the *p* value, in other words the higher the classroom shortfall (as a proportion of all educators), the greater the number of educators not assigned to classes. In the 800 learner school we have referred to, if there is a classroom shortfall of 3 rooms, the number of teachers not assigned to classes *decreases* from 8 to 7.

Regression models, especially ones with an R^2 value as low as 0.333, need to be interpreted with much caution. The view of the data offered by the next graph gives us what we would expect, namely that as the teacher/classroom ratio increases above 1.0, the gap between the raw school L/E and the effective school L/E ratio widens (signifying an increasing *p* value). This graph is based on an analysis of the 5,520 schools without FET. Yet the analysis does reveal one crucial point, namely that high *p* values, or the tendency for the number of classes to be well below the number of educators in a school, is not caused only by classroom shortfalls. There are clearly other forces at play. Dealing with classroom shortfalls in the schooling system is important, but without other, accompanying interventions aimed at a better utilisation of educator time, additional classrooms will not on its own solve the problem of excessively large classes.

Figure 16: Annual Survey relationship between L/E ratios and classroom shortfalls



Some examples of what the above graph is saying:

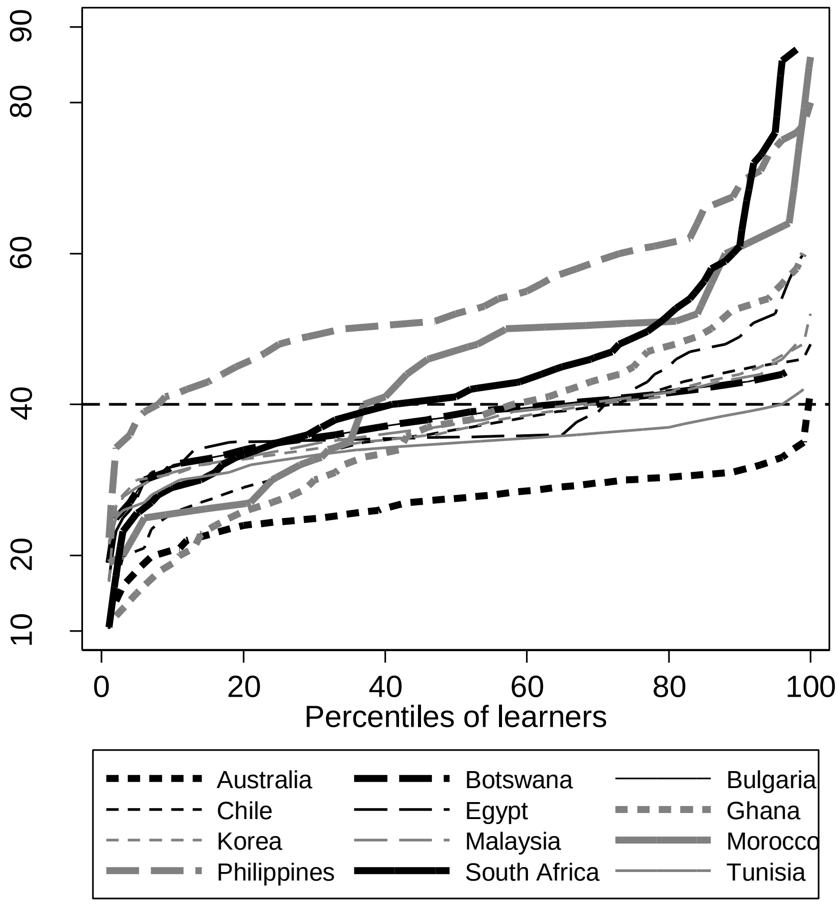
- Where the teacher/classroom ratio is 1.0 (in other words the number of teachers equals the number of classrooms), the effective school L/E ratio is around 45, and the raw school L/E ratio is around 38. The difference is thus about seven.
- Where the teacher classroom ratio is 1.6 (there are many more teachers than classrooms), the difference between the effective and the raw school L/E ratios is about 16.

Returning to Figure 14, it should pointed out that the difference between the effective school L/E ratio and the class L/E ratio is not that different in the ASS and Snap Survey datasets – the gap is slightly larger in reality (the ASS) than it is in the simulation. What we can conclude from this is that one factor that is *not* causing high class sizes is high inequality *within* schools with respect to class sizes. Once a school has decided how many teachers should be attached to classes, the distribution of teachers across grades, and across classes within grades, is relatively equitable. The fact that the gap should be slightly larger in reality than it is in the simulation should not be a cause for concern as there is no policy directive for a school to ensure that, for instance, maximum equity between Grade 1 and Grade 7 be pursued with respect to class size. A number of educational factors may make some inequity sensible.

The high *p* values in the schooling system, of between 20% and 32% according to Table 24, are echoed in the low teaching hours amongst South African teachers found in the ELRC's 2005 educator workload study (ELRC, 2005). That study found that teachers teach on average 3.2 hours a day. This is an average for all schools-based educators, including those managers required to teach only part-time. An adjustment, using the figures published in the ELRC report, was performed to find the average daily teaching hours of full-time teachers. This figure was found to be 3.6 hours a day. To obtain a value that is comparable to the *p* value used in this report, we should gauge the difference between the average learner time per day (this comes to about 5.2 hours) and the 3.2 hours of teaching time per educator (including managers) per day. The difference is 2 hours, meaning 38% of the time of educators in schools is not used for teaching purposes. This 38% is comparable to our *p* value. Given that this report uses data for many more schools than does the ELRC study, the range of 18% to 32% provided here seems to be a more reliable indicator of what the situation is on the ground. But the basic conclusion of both analyses is the same, namely that learners are receiving far less contact time than what is prescribed in policy.

Could the ASS data on number of classes per grade be fundamentally flawed? The ASS dataset is problematic on a number of levels, so this possibility cannot be discounted. Fortunately, a completely separate data source allows us to perform a check on the actual distribution of class sizes in the schooling system in 2003. This is the international TIMSS 2003 dataset, which apart from containing learner performance scores, also contains data on various school characteristics, including the class sizes experienced by the sampled learners (in the case of South Africa, just under 9,000 Grade 8 learners were sampled).

Figure 17: International comparison of class size



Source: TIMSS 2003. Note: Usage of weights was in accordance with the TIMSS manuals.

Some examples of what the above graph is saying:

- Around 10% of learners in South Africa are in classes with more than 65 learners. Around 40% of learners are in classes with more than 45 learners.
- In Australia, virtually all learners are in classes with fewer than 35 learners, whilst in Philippines over 90% of learners are in classes with more than 40 learners.

The curve for South Africa is in fact remarkably similar to the ASS curve of Figure 17, which seems to confirm the basic accuracy of the ASS data both with regard to class size and the *p* value. The other countries represented in the graph are all the African countries participating in TIMSS, a small selection of non-African developing or middle income countries, and one developed country, namely Australia. Class size was not a consideration in the selection process. Class sizes in Philippines are exceptionally high, for almost all learners, and at the high end there are very large classes, as in South Africa. The curve for Morocco is the one most similar to the South African one. Importantly, all the other developing or middle income countries have class sizes which, whilst hardly ever as low as those of Australia, never reach the very high levels found in South Africa, Philippines and Morocco. The class size literature in the economics of education suggests that class size barely makes a difference to the performance of learners. However, one should remember that a lot of that analysis is based on gauging the effects of decreasing class sizes in the range below 50 learners. According to the above graph, 20% of South African Grade 8 learners are in classes with more than 50 learners. It is likely that differences between, say, 50 and 60 learners in a class would have a major negative impact on learning, partly for basic physical reasons relating to classroom size.

4.8 The distribution of 'viable FET subject teaching'

The question of whether there are enough teachers in schools offering Grades 10 to 12 to cater for the new FET schools curriculum receives attention. (The adequacy of teacher skills, knowledge and qualifications is not dealt with here. Only the total number of educators is of concern in this analysis.) It is found that even exceptionally small schools offering the FET grades have sufficient publicly employed educators to comply, albeit in a very basic manner, with the curriculum. Around 70% of Grades 10 to 12 learners are in schools that have a sufficient *number* of teachers to offer 12 FET subjects other than mathematics, English and life orientation (assuming an optimal availability of subject specialisation).

Only in the FET band does the curriculum provide for subject choice. A school that offered the entire selection of FET subjects would need to offer all the 39 subjects in the curriculum, plus possibly some foreign languages. Clearly there are important planning decisions that need to be taken with regard to the degree of choice that can be offered in various schools, and in the various poverty quintiles, within the budget constraints. All this has implications for the distribution of publicly employed educators. It should be noted that although there is no subject choice in the GET band, there is some degree of subject specialisation amongst teachers in GET. However, this specialisation is relatively easy to deal with in terms of the distribution of teaching posts. We can think of GET teachers exchanging classes with each other in order to make full use of teacher specialisation. In terms of the number of teachers required, it is still feasible to think in terms of one full-time teacher per class.

In the FET band, however, the very concept of the class becomes blurred. For example, learners who attend the same mathematics class may split up into two different subject classes during another period. It is therefore useful to think of the demand for teachers in the FET band in terms of the total learner contact hours required across all the FET grades in, say, a week. This will become clearer below, where we examine what the threshold size that a school must reach is for the new FET curriculum to be viable. It will be shown that this threshold size is very low, and that there is no serious school size problem standing in the way of a very basic offering of the new curriculum.

We can think of the smallest FET band in a school consisting of the three non-merged FET grades plus three teachers. On the basis of the simulation used for the previous sections, we can conclude that there are around 276 schools in the system belonging to this very small school category. These schools serve around 1.4% of FET learners in the system. In other words, 98.6% of learners are in schools that are larger, and thus are better placed to offer the FET curriculum. The following table illustrates a teacher and subject provisioning scenario for this 1:1:1 school (the school has one class group in each of the three grades):

Table 26: Simulation of school with 1:1:1 FET structure

	Hrs./week/ class	G10	G11	G12	Hrs./week	Teacher
Language 1	4.5	1	1	1	13.5	T1
Language 2	4.5	1	1	1	13.5	T1
Life orient.	2.0	1	1	1	6.0	
Math. combined	4.5	1	1	1	13.5	T2
Accounting	4.0	1	1	1	12.0	T2
Business studies	4.0	1	1	1	12.0	T3
Geography	4.0	1	1	1	12.0	T3

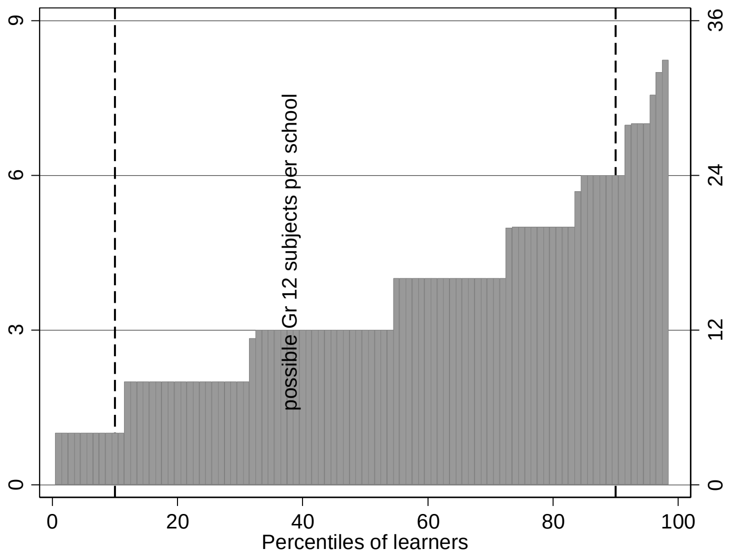
	Hrs./week	Min.	Remainder
Teacher 1	27.00	29.75	2.75
Teacher 2	25.50	29.75	4.25
Teacher 3	24.00	29.75	5.75
Total remainder			12.75

Mathematics and the two languages require 13.5 hours of teaching per week (4.5 hours for each grade), and three other subjects require 12.0 hours. It is possible to divide the teaching of these six subjects up amongst three teachers, each with two specialisations. Even the teacher who teaches the most hours per week, namely the language teacher T1, reaches a total of only 27.0 hours per week with her two subjects, which is within the 29.75 minimum teaching time requirement of the ELRC agreements. If we add up the remaining time that all the three teachers have, we reach 12.75 hours, which is sufficient to cover the life orientation time requirement of 6.0 hours. The assumption is thus that in this hypothetical school, life orientation is offered by teachers in addition to their basic two specialisations. Another important assumption is that mathematics and mathematical literacy are taught within the same class, by the same teacher. The curriculum does not specify whether the two mathematics can be taught jointly, but discussions with planners seems to indicate that there is an expectation that they should not be taught jointly. This clearly poses a challenge for the 1:1:1 FET structure described in Table 26. However, for larger schools, separate teaching of the two mathematics is not a problem, as will be seen below.

We can consider the 1:1:1 FET configuration illustrated above as being the basic building block of this band. A 2:2:2 school would be twice this building block, and we could think of one half of this school replacing accounting, business studies and geography with another three subjects. It is probably likely that one of these three other subjects would be mathematical literacy, to allow for the accommodation of mathematics and mathematical literacy in separate classes. We could even think of the one half of this school offering two different languages, although given the informal status of English, in practical terms it would only be one language that would differ. In theory then, the 2:2:2 school could offer 11 subjects as opposed to the 7 subjects of the 1:1:1 school (assuming that all learners take English). What about a 3:2:1 school, or a school with an enrolment pattern that required, at any point in the day, for there to be a minimum of three Grade 10 classes, two Grade 11 classes, and one Grade 12 class? There are many such schools in the system. Such a school would be the equivalent of the 2:2:2 school in terms of size (6 teachers teaching at a typical point in the school day), but its constraints in terms of subject choice would work differently. If we assume that we cannot offer subjects in Grade 10 or 11 that cannot be taken through to Grade 12, then the number of Grade 12 classes becomes the final determinant of the subject diversity that can be accommodated by the school. The possible subject diversity of the 3:2:1 school therefore becomes that of the 1:1:1 school. In fact, a key indicator of the viability of subject diversity is the number of Grade 12 classes in the school (where 'class' is understood as the number of learners being taught together at a typical point in time during the school day).

The following graph illustrates the number of Grade 12 classes per school experienced by percentiles of learners, on the basis of the simulation mentioned earlier. The right-hand axis of the graph is the number of classes multiplied by four. This multiple can be regarded as a rough indicator of the maximum number of different subjects *other than mathematics, life orientation and English* that can be offered in the school, on the basis of the 'building block' concept discussed above. It is important to think of this as a ceiling, however. In reality, a number of constraints, in particular the availability of teaching skills, would keep schools below this ceiling.

Figure 18: Distribution of Grade 12 classes and possible subject diversity (national)



Some examples of what the above graph is saying: ▪ Just over 10% of learners are in schools with only one Grade 12 class. ▪ Just under 70% of learners are in schools that would be in theory have sufficient teachers to offer 12 different FET subjects other than mathematics, English and life orientation (this is assuming that the teachers had the required specialisations).

4.9 The distribution of 'L/N ratios'

In three provinces, GP, WC and NC, the distribution of publicly employed non-educators across schools is relatively adequate and equitable. In most of the other provinces, the inequities are glaring, and in some, notably LP, KN, EC and MP, there are so few non-educators relative to learners that increasing the number of posts seems unavoidable. Whilst we would not expect the percentage of learners in schools with at least one non-educator to be 100% (provisioning non-educators to the smallest schools is arguably not efficient), this statistic is almost certainly too low in LP (24%) and EC (39%).

As the next table indicates, there are 294 learners for every schools-based publicly employed non-educator in the country (we refer to this ratio as the L/N ratio here). This statistic is calculated by dividing all learners by the number of publicly employed non-educators based at schools. The ratio varies greatly across provinces. An exceptionally poor (in other words high) ratio in LP stands out. In the country, 62% of schools have no publicly employed non-educator, and 41% of learners are in schools with no such staff. Separate analyses have shown that publicly employed non-educators are distributed in a highly regressive, or pro-rich, manner across schools with the exception of GP.

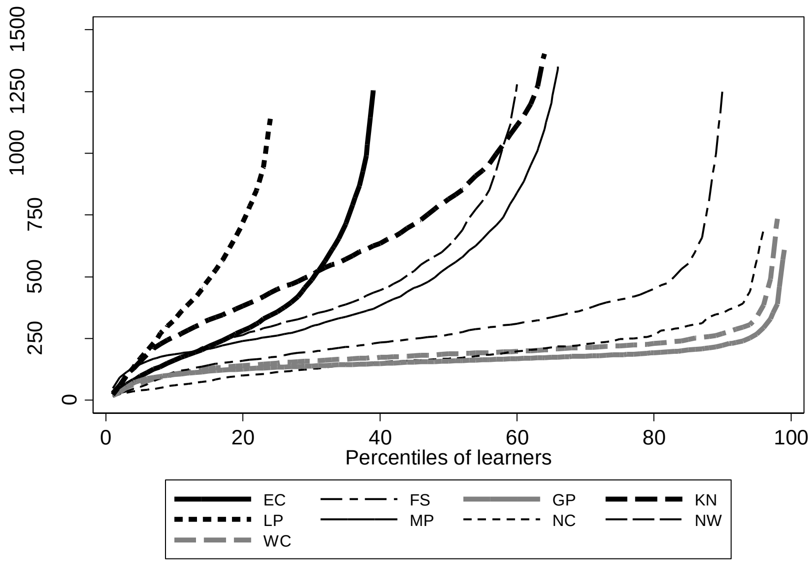
Table 27: Averages for 'L/N ratios'

	L/N ratio (for all schools)	Schools with no non-educator	% learners with no non-educator in the school
EC	435	73%	61%
FS	185	58%	11%
GP	138	1%	1%
KN	494	56%	35%
LP	721	83%	76%
MP	401	55%	33%
NC	120	21%	4%
NW	345	55%	40%
WC	157	15%	3%
SA	294	58%	37%

Apart from some 42,000 publicly remunerated non-educators in schools, there are some 21,000 privately remunerated non-educators. This tends to exacerbate the regressivity of non-educator distribution.

Figure 19 illustrates the provincial distribution curves for publicly paid non-educators. Where a curve ends in the middle of the graph, it means that there is no non-educator at all in some schools, so there is no L/N ratio relevant to the learner.

Figure 19: Distribution of raw public L/N ratio at school level (provinces)



Some examples of what the above graph is saying:

- In the provinces GP, WC and NC, more than 90% of learners have at least one non-educator present in the school, and the L/N ratio experienced by these learners is below 250.
- In FS, almost 90% of learners have a non-educator present in the school.
- In LP, almost 80% of learners have no non-educator present in the school.

4.10 The 'no classroom' phenomenon

The number of classrooms in the country exceeds what we could consider to be the number of full-time teachers in the country by about 70,000. However, because of the way classrooms and teachers are distributed, there are about 116,000 classrooms 'in excess' in certain schools, whilst some 47,000 class teachers find themselves without classrooms in other schools. Importantly, these figures are obtained using certain policy-based assumptions around who is a full-time class teacher and who is not. In actual fact, schools organise themselves in such a way that they reduce the number of educators in the school who are considered full-time class teachers, thus reducing the number of classes, and the effective classroom shortfalls. This pushes class sizes up, and, as indicated in a previous section, implies an under-utilisation of teachers.

This section examines in some detail the issue of classroom availability in schools. The following table compares the number of publicly employed full-time teachers in schools (full-time equivalents are included in this statistic) with the number of classrooms. Note that the full-time teacher statistic used is the one obtained from the simulation using Snap Survey data, not from the Annual Survey classes per grade question. The full-time teacher statistic is in other words actual publicly employed educators per school (according to the Snap Survey) adjusted downwards according to a simulation to cater for the management load of certain educators. Only school records where some statistic on the number of classrooms existed (either from the 2000 or 2004 source, as explained in section 4.2) were used.

Table 28: Simulation results relating to 'teachers with no classroom'

	A Full-time teachers	*B Classrooms*	*A/B*	*C Classrooms with no teacher*	*C/B*	*D Teachers with no classroom*	*D/A*
EC	57,182	77,417	0.74	27,619	36%	7,384	13%
FS	20,982	33,492	0.63	14,405	43%	1,895	9%
GP	41,587	46,180	0.90	10,816	23%	6,223	15%
KN	68,360	83,191	0.82	21,153	25%	6,322	9%
LP	50,902	42,809	1.19	4,803	11%	12,896	25%
MP	22,138	17,083	1.30	2,074	12%	7,129	32%
NC	5,772	6,981	0.83	1,858	27%	649	11%
NW	26,537	46,407	0.57	23,420	50%	3,550	13%
WC	24,125	33,634	0.72	10,099	30%	590	2%
SA	317,585	387,194	0.82	116,246	30%	46,639	15%

The first thing that stands out is that there are more classrooms than full-time teachers in the country as a whole, and in all provinces except for LP and MP. However, if we count the number of classrooms that exceed the number of full-time teachers in individual schools, we find that 116,246 are not utilised. We should interpret this figure cautiously. Some telephonic checking of the situation in individual schools took place where contacts were available. Four schools in WC, MP and LP were checked in this manner. This very rudimentary control revealed, firstly, that the figures in the dataset were correct and, secondly, that classrooms from the set of 116,246 classrooms just mentioned are in fact not under-utilised. Some classrooms are in such a poor state that they are unusable. Others are used not as the principal place of accommodation for individual classes, but as additional rooms to house media collections, and facilitate the school's feeding scheme. What is of greater concern for education planning than the 116,246 statistic, is the 46,639 statistic, representing teachers without classrooms. Again, the interpretation should be cautious. This does not mean that there are in actual fact some 45,000 classes 'under trees'. The reality check using the Annual Survey data in the previous section showed that schools tend to have much fewer classes than one would expect from a policy-based simulation. Put differently, they over-utilise existing classrooms, by over-crowding them, whilst they under-utilise teachers, especially where there are fewer classrooms than teachers in the school (though, as shown in the previous section, this pattern is common even in schools with *no* classroom shortfall). Nevertheless, the 46,639 statistic does indicate what the number of new classrooms needed in the system is. The last column shows that the two provinces, MP and LP, with an overall gross shortage of classrooms (according to A/B), are also the two provinces with the highest proportion of teachers lacking a classroom in which to teach (D/A). It is noteworthy that GP emerges with the third worst situation in the last column – in this province, 15% of full-time teachers do not have a classroom in which to teach. The situation in this province is rather different to the situation in the other 'rich' province, WC.

The following table was constructed to examine whether a difference was made (at the national level) if only schools with classroom data from the 2004 data source were used. The second row indicates that using the 2004 data reduces the percentage of teachers who do not have a classroom from 15% to 12%. This could at least partly reflect the construction of new classrooms between 2000 (the year of the School Register of Needs) and 2004. Focussing on those schools with primary grades only (and no secondary grades) reveals a situation similar to the national situation. A similar focus on just secondary schools reveals that these tend to have a slightly higher percentage of teachers without classrooms. This may only be a construct of the simulation used. It could be that the secondary schools, in making use of subject teaching in Grades 10 to 12, systematically reduce the number of classes, and hence also the effective classroom shortfall.

Table 29: Simulation results relating to 'teachers with no classroom' (national)

	A Full-time teachers	*B Classrooms*	*A/B*	*C Classrooms with no teacher*	*C/B*	*D Teachers with no classroom*	*D/A*
All data	317,585	387,194	0.82	116,246	30%	46,639	15%
Only 2004 data	250,672	328,332	0.76	108,044	33%	30,384	12%
Primary	157,812	204,400	0.77	66,807	33%	20,219	13%
Secondary	105,552	116,254	0.91	28,719	25%	18,017	17%

The next table shows that in all provinces, the proportion of *learners* without classrooms is less than or equal to the proportion of teachers without classrooms. This is largely a function of the simulation approach, which put larger classes into existing classrooms before smaller classes.

Table 30: Simulation results relating to 'learners with no classroom'

	% teachers with no classroom (D/A)	*E Learners*	*F Learners with no classroom*	*% learners with no classroom (F/A)*
EC	13%	2,056,368	211,764	10%
FS	9%	635,866	41,053	6%
GP	15%	1,537,007	204,526	13%
KN	9%	2,594,306	206,979	8%
LP	25%	1,786,721	410,436	23%
MP	32%	818,547	131,196	16%
NC	11%	198,799	17,448	9%
NW	13%	883,946	99,842	11%
WC	2%	908,767	20,129	2%
SA	15%	11,420,327	1,343,375	12%

If the results from Table 30 are obtained for just primary and then secondary schools, the pattern is again observed that secondary schools have a larger problem in terms of classroom shortfalls, at least if the simulated configuration of classes within schools is taken as a point of departure. That secondary schools should experience more severe shortfalls is compatible with the fact that between 1995 and 2004, enrolment in Grades 1 to 7 declined by 7%, whilst enrolment in Grades 8 to 12 increased by 22% (best possible historical enrolment figures available in the DoE used).

Table 31: Simulation results relating to 'learners with no classroom' (national)

	% teachers with no classroom (D/A)	*E Learners*	*F Learners with no classroom*	*% learners with no classroom (F/A)*
Primary	13%	5,724,493	567,606	10%
Secondary	17%	3,690,305	545,605	15%

5 The intended and actual effects of the post provisioning system

Whilst PEDs appear to be applying the post provisioning norms correctly, there is an important anomaly that arises when we compare the distribution of educators intended by the policy, and that existing on the ground. Very small schools are in fact better provisioned with publicly employed educators than what they should be, according to the norms. There is no obvious explanation for this, but it is likely that PEDs are responding to a real need in small schools by allocating more educators to these schools on an ad hoc basis (after the model has been run). This could suggest that the post provisioning norms should be more generous to small schools than they currently are.

There has been only limited monitoring over the past few years of the compliance by PEDs with the post provisioning norms, and of the extent to which the effects on the ground reflect the intention of the policy. Two compliance questions are considered here, in a simple analysis that focuses mainly on just one province, Mpumalanga. The focus on this province is simply a matter of data availability.

- The first question is: Is the PED using the right input data in applying the post provisioning norms, and are formulas being applied correctly? This question has been tackled by the ELRC's post provisioning analysis (ELRC, 2005a).

- The second question is: To what extent does the actual distribution of publicly employed educators in the schooling system reflect the intended distribution of the post provisioning norms? If there is a deviation, which schools are losing, and which are gaining, relative to the policy intention? What might the reasons be for a deviation? With respect to this last sub-question, there could be many reasons, including the incorrect application of the policy, difficulties in filling posts allocated to schools, and difficulties in moving employees from schools that have lost posts.

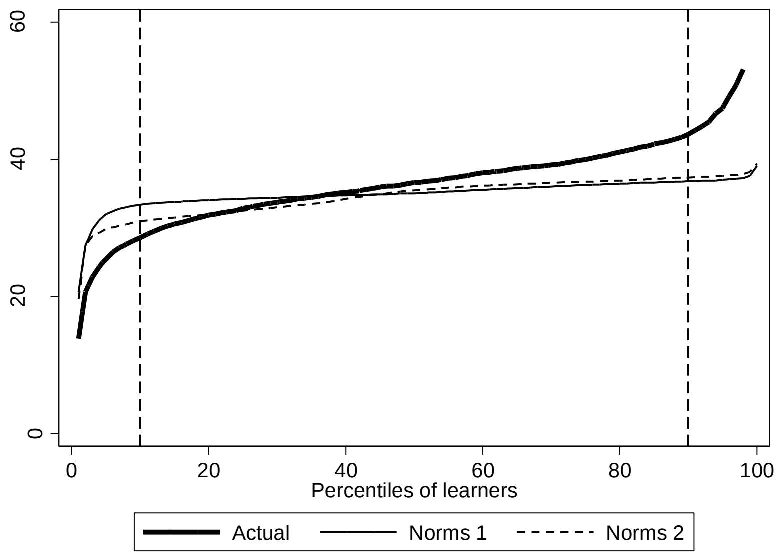
The following graph deals with both of the compliance questions referred to above through the representation of three distributions of the raw school L/E ratio in MP:

- *Actual* refers to the distribution of the raw school L/E ratio using the 2004 Snap Survey data (learners and educators). (The ratio in all three curves is all learners divided by all publicly employed educators per school.)

- *Norms 1* represents the results of an application of the 2002 post provisioning norms using 2004 Snap Survey data (learner data only) as the input data. This simulation was done for this present study. In this simulation, subject data and language of learning and teaching data was not used (this data is available in the Annual Survey but not the Snap Survey). This means that these elements of the norms was excluded. Another element of the norms that was excluded was the pro-poor funding advantage introduced in the 2002 norms. *Norms 1* therefore represents a rather imperfect simulation of what the norms intend, but as we shall see, it is nevertheless instructive.

- *Norms 2* represents the raw school L/E ratio as implied by weights per school actually calculated by MP, and actually used to distribute educator posts in 2005. It is not clear what the data sources are, but one can presume this was 2004 learner data from the Snap Survey and Annual Survey datasets. The weights per school were obtained from the analysts working on the ELRC post provisioning report.

Figure 20: Raw school L/E ratio (Mpumalanga)



With regard to the first compliance question, there is not a great deviation between the independent simulation of the policy application (*Norms 1*) and the actual application of the policy (*Norms 2*). More or less, MP is running the model correctly. It should be remembered that *Norms 1* left out some elements of the model. That MP's application of the model is essentially correct is also the conclusion drawn in the ELRC report, which says (ELRC, 2005a: 8):

> The analysis of the outcomes of applying the [Post Distribution Model] in Mpumalanga and KwaZulu/Natal demonstrates that the PDM is generally consistent with the principles outlined in the Government Gazette of 15 November 2002.

With regard to the second question, however, there seems to be a relatively large deviation, in two respects. Firstly, small schools (the schools with the low L/E ratios represented on the left-hand side of the graph, are better resourced in reality than what the policy prescribes (their actual L/E ratios are lower than one would expect). Secondly, non-small schools (in the middle and on the right) are worse resourced in reality (their L/E ratios are higher than one would expect). It is likely that the problem in the non-small schools relates to difficulties in filling posts. However, it should surprise us to see schools being *better* resourced in reality than in terms of the policy. How would they obtain the additional educators? one must ask. Some more details can assist in illustrating the nature of the deviation. In terms of schools and posts, the *Norms 2* distribution implies that 147 schools in MP should have just one educator. The actual situation according to the Snap Survey educator data, on the other hand, indicates that there are only 99 schools with one educator post. According to *Norms 2*, 458 schools should have a raw L/E ratio below 28.0. In reality, however, only 233 schools fall below this L/E threshold.

The pattern for MP with respect to *Actual* and *Norms 1* is also evident in the other provinces (*Norms 2* was not reconstructed for the other provinces, because the weights calculated by the other eight PEDs were not obtained). It seems as if PEDs are distributing posts more generously to small schools than the 2002 norms permit. It is known that ad hoc allocations of posts occur outside the model, and it could be that these ad hoc allocations are addressing a strong demand for more posts in smaller schools, beyond what the 2002 model can provide. Even increasing the 'base number of weighted learners' in the 2002 model does not change the *Norms 1* curve substantially, though the curve becomes somewhat more generous to small schools. 'Base number of weighted learners' is a factor in the post provisioning norms that provides an advantage for small schools.

6 Simulations to examine specific distribution dynamics

Two important issues that would pertain to teacher distribution models in any country are discussed below. Firstly, the question of the level of the input data is addressed. Secondly, the nature of the trade-off between smaller classes in some schools and larger classes in other schools is examined.

6.1 School, phase and grade as input levels in the model

At first appearance, a distribution model that explicitly places a maximum cap on class size may seem like a viable way of dealing with large classes. However, a modelling of such an approach reveals that it would cause undue year-on-year instability with respect to the movement of teachers between schools. It may also introduce new and perverse incentives with respect to grade repetition. Whilst an approach focussing on the L/E ratio at the level of the school may not deal explicitly with the sizes of individual classes, it is better for stability and equity in the system. It should be kept in mind that the existing post provisioning model is to a large extent such a school-level L/E model.

The 2005 ELRC study compared the application of the 2002 post provisioning norms to a simple approach where just total learners per school was used to distribute the pool of educator posts across schools. It found the two approaches to be very similar. The post provisioning norms are thus strongly focussed on the use of school-level enrolment (i.e. total enrolment of the school) as the determinant of the post establishment for each school.

In the planning discourse, the possibility of a distribution model more focussed on grade-level enrolment is sometimes considered. Interest in such a model is driven by a desire to ensure that class sizes do not exceed a certain threshold limit. Such a model would say that the enrolment per grade would divided by a threshold figure, say 38, and that the result, rounded upwards, would be the number of educator posts teaching in that particular grade. The threshold figure could be different for different grades. Such a model would very explicitly ensure that no class would ever be larger than the threshold level. There would be no class with more than 38 learners, for instance (assuming, of course, that all posts were filled). The threshold level would be determined partly by the available personnel budget in the province. This model using grade-level enrolment as the driver of teacher allocation seems attractive, largely because of its explicit treatment of class size. However, as will be shown, such a model has distinct disadvantages. There are alternative ways of dealing with the matter of maximum class size in a distribution model.

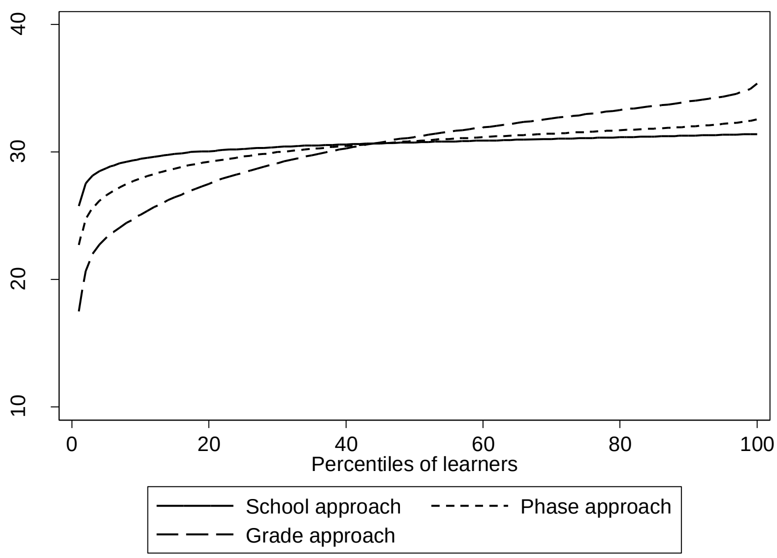
One disadvantage with the grade-level model is that it causes higher levels of instability in terms of teachers that must move between schools from one year to the next. The next table illustrates this point. Three distributions were simulated, each focussing on a different level: the school, the phase, the grade. Each distribution was simulated twice, once for 2003 and once for 2004, using the Snap Survey data for these two years. In the simulations, the only criterion was that the L/E ratio of the applicable level should not exceed a critical threshold, where that threshold was determined within the model and was dependent on the fact that the total number of educator posts was held constant at 330,000 for both years. Around 3,700 small schools servicing 12% of learners were excluded, in order to exclude the complexity of grade merging. The next table indicates that there is clearly an instability cost that rises the lower the level of the data used in the model. Using grade as opposed to school means that an additional 650 educators must move between schools from one year to the next. Using phase has a smaller instability cost than using grade.

Table 32: Comparison of data level effects on stability

	Educators forced to move 2003 to 2004	Proportion of all educators
Use of grade-level L/E	14,197	3.86%
Use of phase-level L/E	13,980	3.85%
Use of school-level L/E	13,544	3.76%

A second disadvantage with the grade-level approach is that it produces high inequalities in the school L/E ratio. Whilst the grade-level thresholds explicitly ensure that classes do not exceed a specific size, this kind of micro-modelling results in the school-level L/E ratio being rather different in different schools. This is illustrated in the next graph, in the distribution curves for the school L/E ratios corresponding to the three approaches. The left-hand side of the graph need not concern us too much, as this relates to smaller schools left in the dataset, after the removal of the 3,700 smallest schools. One would normally deal with smaller schools with a special small school element in the distribution model (this is the case in the 2002 model, and in most teacher allocation models). What should concern us is the inequalities appearing on the right-hand side of the graph, in other words in larger schools. Using grade-level data pushes the very highest school L/E ratios to higher values. At the 98th percentile, the school L/E ratio is 34.8 using grade data. Using school-level data, that figure becomes 31.4.

Table 33: Comparison of data level effects on between-school equity



What do these equity effects mean in practical terms? Teachers might prefer the certainty of grade-specific class size thresholds, because this would provide explicit protection against large classes at a policy level. However, grade-specific thresholds also provide new opportunities for gaming the system. With a simple school L/E model, the only honest gaming that can occur is that the school will attempt to attract additional learners in order to attract additional teaching posts. Of course dishonest gaming could occur where school principals fraudulently increase their total enrolment in their statistical returns. With grade-specific thresholds, however, there is an incentive to arrange the distribution of learners across grades in such a way that the total staff complement of the school is maximised. In simple terms, by keeping one learner back in a grade (either in reality or fraudulently in the statistical returns), a school could change its staff complement by one teacher.

In can be concluded that a distribution model that was very micro-sensitive and placed hard maximum limits on class sizes is not a desirable policy, as this would increase year-on-year instability in the teacher force, would produce school-level inequities, and would introduce new perverse incentives. However, this should not detract from the importance of monitoring class sizes, and advocating strongly for a sufficient number of educator posts in the province, capable of keeping class sizes within reasonable limits. Ways of doing this, whilst retaining a distribution model that largely focuses on school-level enrolment figures, are discussed in section 8.

6.2 The trade-off between smallest and largest class sizes

In practically all teacher distribution models, there is a trade-off between the smallest classes allowed for in small schools, and the size of the largest classes in other schools. The smaller the classes allowed in small schools (and hence the less the extent of multi-grade teaching), the larger the largest classes in other schools. The pattern of this trade-off is modelled on the basis of Snap Survey data. It is found that in many situations, changing the allowance for small classes in small schools has a rather limited effect on the size of the largest classes in the system. For instance, dropping the minimum class size allowed in LP from 20 to 15 decreases class size at the top end by only 0.4 learners. In EC, however, the effect is relatively large. In this province, dropping the minimum class size allowed from 20 to 15 decreases class size at the top end by 1.1 learners. In FS, there is a non-linear trade-off, so below a certain minimum class threshold, the effect in non-small schools becomes very large. Planners need to know what the shape of the trade-off is.

There is a crucial trade-off between small classes and large classes in any schooling system. Figure 10 illustrates this trade-off well. That graph showed that EC's smallest classes were smaller than KN's smallest classes, and that EC's largest classes were larger than KN's largest classes. To some extent, EC could reduce the sizes of its largest classes, by increasing the sizes of its smallest classes. In other words, to some extent EC should be able to realise a distribution more like the KN one. The 'to some extent' is important, because structural issues, such as school and grade group size, limit the degree to which this trade-off can be applied. However, the degree to which small schools are favoured in the model, for instance in the 'base number of weighted learners' of the 2002 post provisioning norms, also plays a role. Put differently, a model can change the threshold at which a small school qualifies for its second educator post. The higher this threshold, the fewer the posts distributed to small schools (and hence the higher the average class sizes in these schools), and the more the posts distributed to larger schools (and hence the lower the average class sizes in those schools). The corollary to the higher class sizes in small schools is of course a greater prevalence of forced multi-grade teaching.

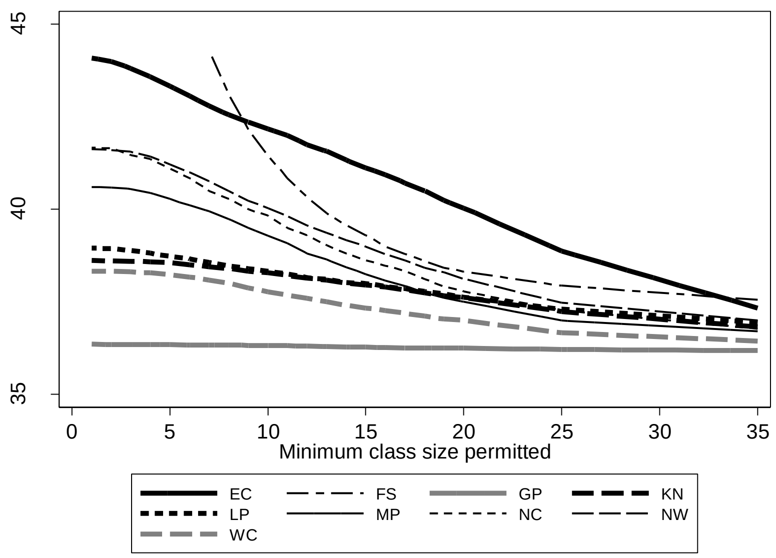
A simple distribution model was developed in order to examine what the trade-off between small classes and large classes might look like in each of the provinces, given the structural specificities of each province, in particular enrolment per school and the number of grades taught in each school. The aim was to see whether this trade-off worked differently in the different provinces, and if so, how. The model forced there to be one educator for every 35.4 learners. The intention behind this uniformity was to isolate the structural effects on the trade-off, and to ignore effects such as different staffing levels, brought about by different budgetary situations in the provinces. The 35.4 ratio is the national average that exists in the 2005 Snap Survey data used, if we factor out school managers. School managers were factored out in order to simplify the model. The model thus assumes that all the educators distributed by the model teach full-time, and therefore influence the effective school L/E ratio as defined in section 4.5 above.

There are many ways in which a teacher distribution model can favour small schools, but the end effect of the different approaches tends to be rather similar. In the distribution model developed here, the educators a school should receive was calculated in two ways, and the school benefited from the best or highest result of the two. In the first approach, which did not favour small schools, educators received was simply the upwardly rounded result of learners multiplied a factor that applied to the whole system. In the second approach, which did favour small schools, enrolment was divided by a ‘minimum class size permitted’, and the result was rounded downwards. As long as this amount did not exceed the number of grades in the school, this was taken to be the educator establishment. The school would obtain the best of the two results, and through manipulating the factor from the first approach, the net ratio of learners to educators was kept at 35.4 in each province. The Excel formula is as follows:

$$= \mathrm{MAX}\left(\mathrm{ROUNDUP}\left(L * F, 0\right), \mathrm{MIN}\left(G, \mathrm{ROUNDDOWN}\left(L / C, 0\right)\right)\right)$$

where L is total school enrolment, F is the factor, G is the number of grades offered by the school and C is the minimum class size permitted. The distribution model was run for various values of C in the range of 1 to 35, and for each province. The resultant picture is captured in the next graph.

Figure 21: Trade-off between minimum and maximum class sizes



Some examples of what the above graph is saying:

- In EC, if the minimum class size permitted in small schools is 20, then we can expect the highest effective L/E ratio (which we can think of as the average class size within one school) in the province to be 40.0. Importantly, with a minimum class size permitted of

20, there would still be classes below this threshold, if the total size of the school was below 20. For instance, a school with five learners would have one educator, and hence a class size of five. However, for a school to get a second educator, it would need to have at least 40 (two times 20) learners. If we reduced the minimum class size permitted from 20 to 15, and did not increase the total pool of educators, then the maximum effective L/E ratio we would find in non-small schools would be 41.1. In other words, dropping the minimum class size parameter by 5, increases the maximum effective L/E ratio by 1.1.

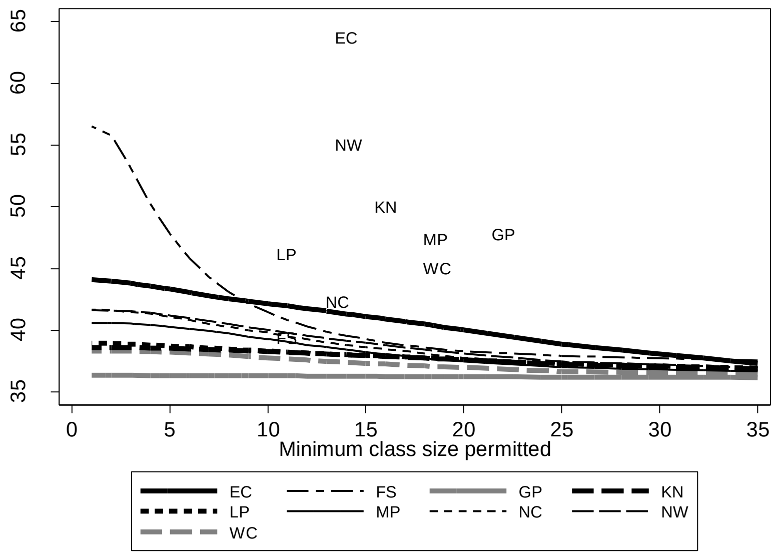
- In LP, dropping the minimum class size permitted from 20 to 15 increases the maximum effective L/E ratio from 37.6 to 38.0. There is thus a smaller cost in terms of the maximum class size in LP, compared to EC, in being generous to small schools.

The trade-off between minimum class size and maximum class size clearly plays itself out differently in the different provinces. Maximum class sizes in non-small schools are more sensitive to the treatment of small schools in the case of EC, than in the case of, say, LP. This is related to the structure of the province's schooling system, specifically the size of schools and grade groups. However, there is no simple correlation between the patterns seen in the graph above and the structural patterns presented in section 4.3. It is thus important to model the actual trade-off, as is done here.

The curve for FS in Figure 21 is the only one that is clearly non-linear. In this province dropping the minimum class sizes permitted from 15 to 10 has a particularly large upward effect on maximum class size in non-small schools. It would be important for decision-makers in the province to be aware of this threshold effect, as it could have major cost or curriculum delivery implications. There seem to be four trade-off patterns in Figure 21. In EC and FS there is a very strong trade-off between the two variables. The trade-off in NC, NW and MP is moderately strong. In KN, WC and LP, the trade-off is relatively weak – for instance, in LP dropping the minimum class size permitted in small schools from 20 to 15 raises maximum class sizes by only 0.4 learners. In GP, the virtual absence of very small schools makes the trade-off practically non-existent. In other words, GP could be very generous to the few small schools that exist, with almost no effect on the maximum class sizes.

Each province is situated at some point in the space of the Figure 21 graph. In other words, in each province a place in the trade-off has already been selected, consciously or unconsciously. This point per province was plotted, to assess the relationship between the modelled curves from Figure 21 and the actual situation. The actual effective school L/E ratio prevailing at the 95th percentile (counting learners) was chosen for the vertical axis (using the maximum, or 100th percentile, brought in too many extreme situations, some of which could be simply the result of data problems). For the horizontal axis, schools with two publicly employed educators were extracted in each province, and the L/E ratio at the 10th percentile (starting from the lowest L/E ratio) was chosen. Strictly speaking, the lowest L/E ratio of schools with two educators should have been chosen, but this allowed some apparent data anomalies to creep in. Importantly, one cannot take the lowest L/E ratio from all schools in each province as an indicator of the minimum class size permitted. A school with five learners would have an L/E ratio of 5, not as a result of some post provisioning decision, but simply because every school must have at least one educator. However, the lowest L/E ratio for schools with a first and a second educator is a function of a post provisioning decision, and so comparisons across provinces do indicate the relative favouring of small schools. In Figure 22, the spread of provinces across the vertical axis is of course not only a post provisioning matter, it is also has to do with difficulties in filling posts. However, the distribution across the horizontal axis is exclusively a matter of post provisioning decisions. In this regard, it is noteworthy that EC is a relatively strong favourer of small schools (its minimum class size permitted is relatively low), despite the heavy cost of this for class sizes in non-small schools. It could be argued that given the EC trade-off, a less generous favouring of small schools could be preferable. LP favours small schools strongly, but because its trade-off curve is flatter, this is arguably efficient.

Figure 22: Actual trade-off between minimum and maximum class sizes



The two above graphs provide a framework for considering the trade-off between small schools and non-small schools with respect to class size. This kind of graph could have a very practical application in the planning of a province's post provisioning. The degree to which small schools are favoured could be varied, to produce a number of different trade-off points. In the case of the 2002 post provisioning norms, this principally means varying the value of the 'base number of weighted learners' (though even other parameters in that policy, in particular the flat weights per grade relating to language of learning and teaching). Joining these different trade-off points would produce the trade-off curve for the provincial schooling system. This would greatly facilitate the selection of an appropriate level of small school favouring for each particular province, because the cost in terms of large classes in non-small schools would become explicit.

7 Summarising the dynamics of teacher allocation in South Africa

This section draws together conclusions from the preceding sections in order to arrive at a schematic representation of how the various L/E ratios and other indicators relate to each other, with an emphasis on which policies influence what indicators. Given that the teacher allocation system is provincial, the focus is on one province, namely Mpumalanga.

Figure 23: The overall teacher allocation picture: Mpumalanga in 2005

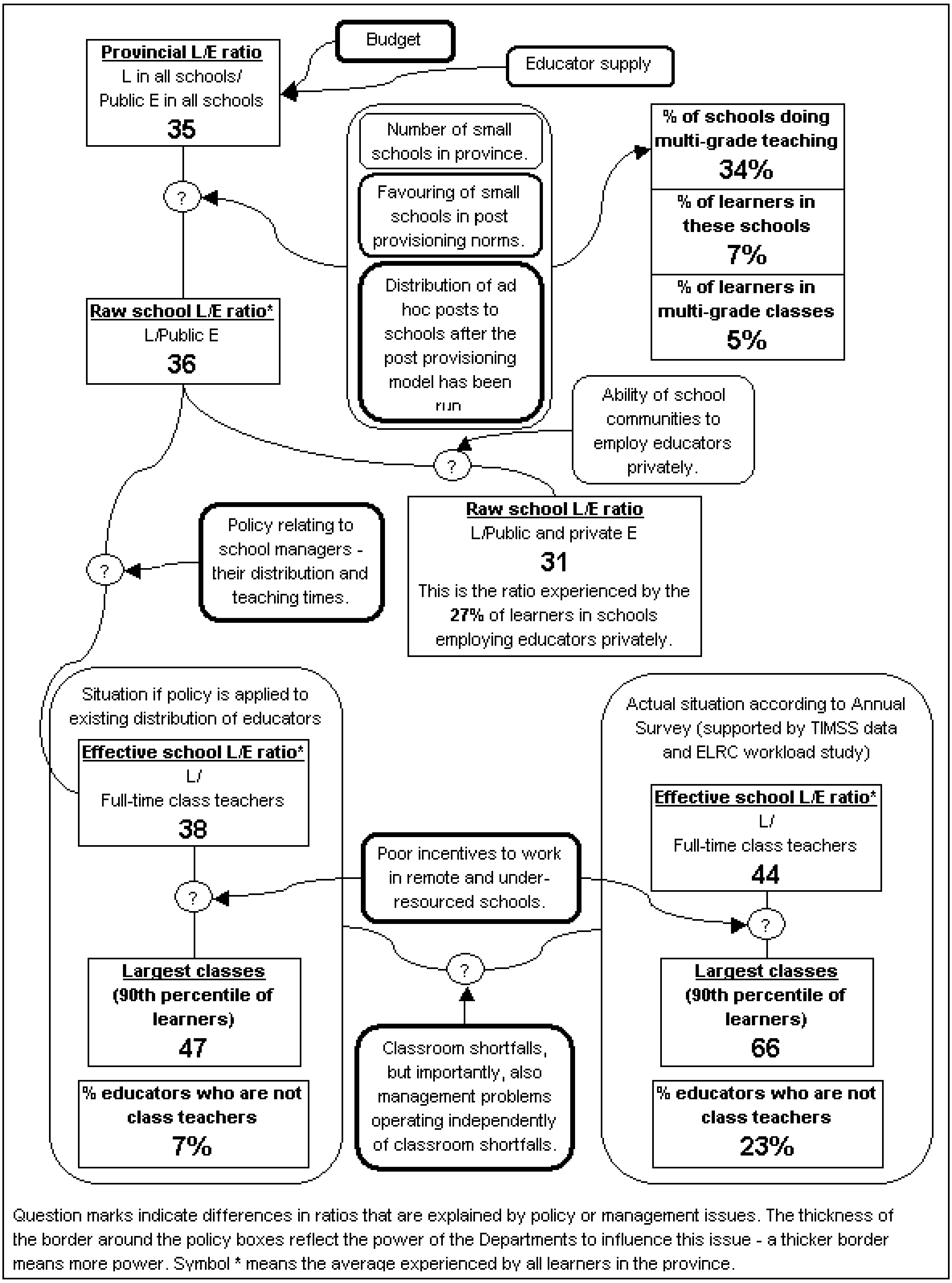


Figure 23 tells us the following:

- The L/E ratio obtained by dividing all Grades 1 to 12 learners by schools-based publicly employed educators is 35. This ratio is to a large extent an outcome of budget availability.

- The raw school L/E ratio is 36, and differs slightly from the L/E ratio mentioned above, because smaller schools enjoy a lower L/E ratio (the raw school L/E ratio presented here is the learner-weighted average L/E ratio experienced by all learners using learners divided by publicly employed educators in each school). The degree to which the two L/E ratios differ depends partly on how many small schools there are in the province, but also on the degree to which small schools are favoured in the distribution system. The post provisioning norms favour small schools to some extent. However, it is also clear from the analysis (section 5) that small schools receive educator posts over and above what the post provisioning model gives them. Presumably, this is the result of ad hoc allocations of posts by the PED.

- The key figures for understanding the extent of multi-grade teaching in MP are the following: 34% of schools have some multi-grade teaching; 7% of learners are in schools where some multi-grade teaching occurs; 5% of learners at any one point find themselves in multi-grade classes.

- In those public schools that employ educators on a private basis (27% of all learners find themselves in these schools), the raw school L/E ratio is 31. This L/E ratio advantage arises because more advantaged communities are able to afford school fees of a sufficient magnitude to cover teacher salaries.

- If we assume that the policies relating to the distribution of school managers (in particular Principals and Deputy Principals) as well as policies relating to their required teaching time are correctly implemented, then the *expected* learner-weighted effective school L/E ratio for the province is 38. The effective school L/E ratio is learners divided by 'effective educators', or educators who are class teachers on a full-time basis. This ratio thus provides the expected average class size at each school. Because we have educator managers who do not teach on a full-time basis, the effective school L/E ratio is higher than the raw school L/E ratio (by 2 learners, in the case of MP).

- Still using the assumption that policies relating to schools managers are correctly applied, and furthermore assuming that schools distribute full-time teachers equitably within the school, we can work out more or less what class sizes we should expect in the schooling system. If we make this calculation, we will see that expected class sizes vary quite substantially. A policy concern would be what the very largest classes in the system are. A useful indicator in this regard is the class size of the learner at the 90th percentile (where learners are sorted by the class size they experience). The expected class size at that point is 47. What this means is that about 90% of learners would be in classes smaller than 47, whilst about 10% of learners would be in classes larger than 47. The reason why the very largest class in the province is not a useful indicator, is that this statistic could be the result of a data anomaly, or of a situation that is so exceptional that it does not warrant being identified as a major policy concern. The fact that expected class size at the 90th percentile should be so much higher than the effective school L/E ratio mentioned above is mainly due to difficulties faced by some schools in attracting educators to work there, though inevitable within-school class size inequalities do play a minor role.

- With an ideal application of the policies, and with ideal school management practices, around 7% of schools-based educators in the province would not be full-time class teachers.

- If we examine what the *actual* class size situation is (as opposed to the expected situation assuming a perfect implementation of policy), we see very different values. The effective school L/E ratio becomes 44 (and not 38). This is because a larger proportion of educators than one would expect (given the policies) are not working as full-time class teachers. The data indicate that instead of 7% of educators not being full-time class teachers, around 23% of them are not in the classroom at any point during the school day. It is logical to link this problem to classroom shortfalls in schools. There are many schools in MP with fewer classrooms than the number of teachers who should be teaching full-time (Table 28 indicated that 32% of the teachers who should be teaching full-time do not have a classroom, whilst Table 30 indicated that this translates into 16% of learners in the province not having the classroom accommodation they should have). However, the data also indicated that even where a sufficient number of classrooms are available, a high proportion of educators are not assigned to classes. In fact, the patterns in schools with enough classrooms are not that different from the patterns in schools suffering classroom shortages. The matter is thus partly one of insufficient classrooms, but also partly one of school management.

- The high effective school L/E ratios existing in reality are one important reason why the class size at the 90th percentile is as high as 66. Another reason would be that school management may not be distributing those teachers who do teach full-time equitably across the school, resulting in exceptionally large classes. Difficulties in recruiting teachers to certain schools are of course also a reason.

8 Policy implications of the data analysis

The analysis in the foregoing sections can be translated into policy implications in a number of policy areas (not just the area of post provisioning). Some of these implications have been expressed as recommendations in other documents. Others are new, or have not received much attention in the planning discourse. This section deals with both implications requiring policy adjustments, and instances where the analysis indicates that no policy action is required, or a continuation of existing programmes seems optimal.

8.1 Implications for the post provisioning norms

In the 2002 post provisioning norms, the element that requires the most urgent attention seems to be the factor favouring small schools. It should be possible to favour small schools more strongly in the formula. An argument is also made for a complete revamping of the post provisioning norms, to make it more intuitive, and more strongly linked to existing learner contact time and teaching time parameters. Such a revamping should include the development of explicit recommendations for maintaining year-on-year stability in the schooling system, a model to distribute non-educator posts amongst schools and a requirement that PEDs approve when schools should enjoy an advantage for the offering of certain FET subjects (existing curriculum liberties at schools should continue, but the *public funding* of curriculum diversity should be more pro-poor and more controlled).

Section 5 of this report indicated that in MP but also the other provinces, small schools are more generously provisioned with publicly funded educator posts than what the post provisioning norms allow. The conclusion was made that PEDs must be allocating posts to small schools on an ad hoc basic in order to satisfy a legitimate demand emanating from small schools. This is arguably the most glaring shortcoming of the existing post provisioning norms.

As a minimum, the post provisioning norms should be revised so that the ‘base number of weighted learners’, which drives the favouring of small schools, becomes more flexible. Currently, the cap on this parameter is 20 weighted learners. This cap should be raised.

In other respects, the post provisioning norms themselves do not seem seriously problematic, though some further problems are raised in this section. The efficiency and equity problems that have been highlighted in this report, in particular the inequities with regard to class size, the fact that on average South Africa's class sizes are large by international standards, and the apparent under-utilisation of educators within schools, are not problems that can be dealt with in a post distribution model. The solutions to these problems largely lie elsewhere (see section 8.3 below). The current post provisioning norms are suitable in the sense that they use the *school* as the primary unit of distribution, and not *grade* (see section 6.1).

However, there are good reasons to make the post provisioning norms more *intuitive* and to synchronise them better with existing policies governing, for instance, learner contact time and teaching time. This is particularly so if we want, firstly, to explain to schools with greater ease how their post establishments should be translated into effective service delivery and, secondly, to gain a clearer sense of the link between the personnel budget and, for instance, class sizes imposed on teachers and learners. A complete revamping of the norms is therefore proposed in this section. This revamping should be understood together with the management information systems proposals made in the following section. The objective in this section is to propose key elements of the revamped policy (separate Excel-based work has already begun to test the revamped model and the associated information tool, and the points made here are informed by that experience).

It needs to be emphasised that the revamping of the distribution formula proposed here is partly independent of the management information tool proposed in the next section. It would be quite possible to build that tool whilst the existing post provisioning norms continue to exist. Given that tool-building tends to be a shorter process than policy revision, it is quite possible that the tool could be implemented before any changes were approved to the post provisioning norms. The tool would require some adaptation once the norms had been revised, but the fundamentals of that tool would remain unchanged.

The revamping of the post provisioning norms would entail four main things:

- Firstly, to make the model more intuitive (or easier to understand in terms of what happens in schools), the educator post distribution model would require the planner to set parameters that would be experienced in reality in the schooling system. For example, to deal with the trade-off between small schools and non-small schools, it is proposed that an explicit criterion (which provinces may vary within limits) be set for the provisioning of the second, and perhaps the third educator post to small schools. This would be more transparent that the current 'base number of weighted learners' in the norms. As another example, the 'period load of educators' from the 2002 norms would be brought in line with existing policy (as described in section 3). The number of teachers in non-small schools would be explicitly linked to whether managers in schools had enough teaching time to take classes on a full-time basis, or not.

- Secondly, the norms would explicitly outline how stability would be pursued from one year to the next, by allowing deviations from the rules to limit inter-school movement of posts and the movement of posts to schools without sufficient classrooms to accommodate the teacher. This would of course have equity implications, and the norms would need to provide parameters for what was an acceptable equity compromise in the interests of stability (and efficiency).

- Thirdly, the norms would become more comprehensive by dealing with the entire staffing package. Specifically, the norms would now also deal with non-educator provisioning and the levels of school managers. Whilst this last matter is dealt with in separate ELRC agreements, it is necessary to deal with this in the post provisioning norms as well given that the levels of managers influence their teaching time, and hence the need for non-managers. The norms would also require PEDs to explicitly state the minimum number of mathematics teachers needed by a school where the school offers FET grades, on the basis of the enrolment by grade pattern of the school. This information would be generated partly to make the issue of the demand for mathematics teachers clearer, and partly to reinforce appropriate recruitment processes at the school level that are in line with the new curriculum. Arguably, similar specifications for the number of English teachers required per school could be made. Though this report has not dealt with the issue of the staffing of Departmental offices that provide support to schools, in particular 'district offices', a truly comprehensive post provisioning policy would need to specify rules and guidelines for this. In addition, it would need to deal with the staffing of special schools (another matter not dealt with by this report in any way).

- Fourthly, the norms would establish policy for determining which schools with FET should receive a provisioning preference due to their offering of subjects requiring smaller classes. Currently, the norms specify that the *actual* enrolment in small class subjects should result in a provisioning advantage. This results in regressive provisioning, as more advantaged schools tend to have more of these subjects. The *public funding* advantage should be coordinated centrally within a province, within a framework that ensured equity across the quintiles in this regard. This would not exclude advantaged schools from using *private funding* to accommodate certain small class subjects.

Some details on the revamped model appear in Table 34 below, which focuses on the budget and policy parameters, and the school data inputs required. Clearly, the exact calculation steps would need to be specified once the principles had been agreed on. Some experimentation on the possible workings of the revamped model indicate that it would be less formulaic than the current model, and more programmatic. Put differently, it would be difficult to reduce the more intuitive and comprehensive model proposed here to one simple equation. It would need to be expressed in terms of a series of calculation steps, some of which would require optimisation (goal-seeking) using computer software. In the following table, R means the item is more or less a repeat from the existing norms, A means a new addition, and C means something from the existing norms is changed.

Table 34: Data elements in the revamped post provisioning norms

BUDGET PARAMETERS	
Total number of educator posts. *This continues to be the key constraint – the norms would still be a distribution model of available resources.*	R
Total number of non-educator posts. This figure would be divided into administrative staff posts and support staff posts *This is also a key constraint – non-educator provisioning would also involve the distribution of a finite pool of posts.*	A
POLICY PARAMETERS	
Thresholds for determination of number of HODs and Deputy Principals in a school. *One important reason why this input data is required is that this informs the split between total teaching time and management time in the school.*	A
Minimum teaching time for managers. *This is a crucial input needed if the effective school L/E ratio and expected class sizes (see sections 4.5 and 4.7) are to be understood properly in the distribution model.*	A
L/E ratio thresholds for the provisioning of the second and third educator posts to small schools. These parameters would perform the function of the ***base number of weighted learners*** in the existing norms. *This is a crucial input that governs the trade-off between minimum class sizes in small schools and the largest classes in non-small schools. The lower these parameter values are, the larger the largest classes in non-small schools (see section 6.2).*	C

Ideal maximum class sizes. This would be similar to the ***maximum ideal class size*** parameters of the existing norms. It is debatable whether these parameters should be specified in terms of the existing phases and bands of the curriculum, or the alternative bundles of grades appearing in the current norms. (The current norms group the grades as follows: 1 to 4; 5 to 6; 7; 8 to 9; 10 to 12.) It is proposed that quintiles be a new dimension for these parameters. In other words, more favourable ideal maximum class sizes would be specified for poorer schools. This would replace the pro-poor 'top-slicing' of the 2002 norms, which is a less transparent way of dealing with progressive provisioning. *Because the norms would remain a model distributing a finite number of posts, the model cannot enforce the ideal maximum class sizes. However, the ideal maximums would be used to weight learners in various grades (and various quintiles) in the distribution of educator posts. Thus although the ideal may not be realised, deviations from the ideal would be relative to those ideals.*	C
Ideal maximum class sizes for small class FET subjects. To avoid excessive complexity, these would be the same across the quintiles. The 2006 proposed revisions to the post provisioning norms already put forward these parameters. Eighteen of the 39 new FET subjects are assigned ideal class sizes below the general level (the general level is 37 learners per class).	R
Time allocation per FET subject. These parameters are included in the 2006 proposed revisions, and they are based on what appears in the new FET curriculum. *These inputs would be combined with the ideal maximum class sizes at the FET band in order to provide final weightings per FET learner. They would also feed into the determination of the number of mathematics teachers required by each school.*	R
SCHOOL DATA INPUTS	
Includes: National EMIS number; School name, Poverty quintile; Total enrolment (by grade); Enrolment with an alternative LOLT (by grade, from Grade 1 to Grade 9 – see comment below); Approved enrolment in small class FET subjects.	C

Linked to the ***maximum ideal class size*** parameters of the 2002 post provisioning norms are some parameters not appearing in the above table. These other parameters are the ***promotion factor***, the ***period load***, and the ***funding level***. The promotion factor and the funding level parameters carry the same value for all subjects and grades in the tables included in the policy (with the exception of zero values for Grade R to signify that Grade R should be provisioned in a different manner). However, provinces may change these parameters in order to weight certain grades and subjects more. This complexity is perhaps best circumvented by simply allowing provinces to change the ideal maximum class sizes, which would have the same end effect.

With respect to period load, this parameter carries different values for different grades in the 2002 norms, and is meant to reflect different teaching loads at different grade levels. The problem with this element of the post provisioning norms is that it does not correspond to the time parameters in the curriculum and in the Personnel Administration Measures (see section 3 of this report). The curriculum and the PAM essentially say that *all* teachers who are not Principals or Deputy Principals are automatically full-time teachers in the sense that their teaching time is always greater than the stipulated learner contact time. Excluding this period load parameter is not the same as banning 'free periods' for teachers in the FET band. As was argued in section 4.5, there are ways to deliver the curriculum in such a way that FET teachers do have free periods, without deviating from the requirement that FET teachers do need to teach at least as many hours as implied by the learner contact time. It should be remembered that the post provisioning norms do not offer a prescription on how a Principal should manage the delivery of FET. The norms merely distribute posts on the basis of the curriculum and labour relations parameters.

It is recommended that alternative LOLT be dealt with only in Grades 1 to 9, and not in Grades 10 to 12 – in the 2002 norms alternative LOLT is used across all grades. There is a technical reason for this, and an educational reason. The technical reason is that in the more intuitive model being proposed (and in the management information tool being proposed in the following section) it would be extremely complex and data-intensive to model alternative

LOLTs where subject-differentiated class sizes exist (this is the case in the FET band). In the 2002 norms this is not a problem, because LOLT is just a weight. There is no requirement to show exactly how this impacts on the utilisation of teachers in a school. Multiple LOLTs at the GET level are relatively easy to model, on the other hand. The educational reason for not considering LOLT in the FET band is that it is far more feasible to expect FET learners to switch between languages (in practice, these languages would be just English and Afrikaans currently) than to expect GET learners to do the same. In the GET band, there is a much stronger need to run completely parallel LOLT streams, given the language proficiency of learners.

8.2 Implications for the monitoring of teacher allocation

Given that the post provisioning challenge is largely one of clarifying and presenting to decision-makers the implications of a complex annual modelling process, a proposal is provided for a comprehensive management information tool consisting of a number of modules. These modules would, amongst other things, examine the class size trade-offs, classroom-teacher relationships, and the impact of different post provisioning scenarios. One module would produce a form for every school that simulated a possible teacher utilisation scenario per school, partly to reinforce policies on teacher utilisation at the school level.

This report has revealed how complex, if not bewildering, the post provisioning issues are. There are many elements that need to be taken into consideration (even if not all of them appear in the post provisioning formula itself): learners, actual educators, posts, classrooms. Data from at least two years must be considered at a time (and perhaps more than two years). The poverty quintiles must feature. The potential service delivery environment per school in terms of class sizes and multi-grade teaching must be made clear (and generally this differs from the *actual* and perhaps inefficient school situation existing on the ground).

To support decision-making, a robust management information tool dealing with the post provisioning norms is needed. Such a tool should not only run the distribution model using the required data, it should also provide management information both to assist in arriving at optimal distribution model parameters (assuming that the norms allow for some leeway in this regard) and to assist in understanding planning outside the post provisioning model, but nevertheless related to post provisioning, particularly classroom provisioning, the recruitment of teachers, and the within-school utilisation of teachers. Moreover, the tool should be able to produce for each school not only the entitlements resulting from the post provisioning norms, but also a proposed teacher utilisation scenario for the school. This scenario, whilst not a prescription, would serve as a strong signal of what the policies regarding learner contact time and teaching time were, and would assist in dealing with the school management problems highlighted in this report (in particular with respect to teachers who are not class teachers – see section 4.7).

The following table contains a proposal for the management information tool. The suite of modules should be developed nationally, given that the post provisioning norms and the surveys that yield the data are national. The last five columns indicate which modules would use which data. The five data categories should be understood broadly. ‘Learners’ would include, for instance, proportions relating to language of learning and teaching (LOLT) and enrolments in specific FET subjects. The symbol ● means data for the outgoing school year, whilst ❍ means data for the new school year.

Table 35: Proposed management information modules

	Management information module	*Learners*	*Educators*	*Classes*	*Rooms*	*Posts*
1	**Trade-off module.** Trade-off between minimum class size in small schools and large classes in non-small schools. [Single graph.] *Purpose is to ensure that planners are aware of any critical thresholds in the trade-off, and hence avoid a wasteful combination of the two. (See section 6.2.)*	●				
2	**Classroom and teacher utilisation module.** Relationship between school enrolment, actual educators per school, posts allocated per school, and instructional rooms. Also difference between actual class sizes and possible classes with the given distribution of teachers and classrooms. [A suite of graphs and tables capturing a set of complex relationships in as readable a manner as possible.] *Purpose is to generate key information relating to the planning of three things: (1) Classroom construction. (2) Better school management and timetabling that leads to a better utilisation of educators. (3) Better strategies to attract teachers to unattractive schools.*	●	●	●	●	●
3	**Learner data analysis module.** Patterns in the data inputs used for the post provisioning model, for instance with respect to subject diversity at the FET band, and the extent of multiple LOLTs in schools. This information should be arranged by quintile so that the equity picture becomes clear. [A set of tables.] *Purpose is to let planners gain an overall picture of the data patterns that will drive the distribution of posts. In particular, planners can be alerted to possible curriculum provisioning inequities that might make the post distribution unacceptable.*	●				
4	**Post provisioning scenario generation module.** The actual calculation of posts per school for the new year. *Essentially this is what the post provisioning tool developed nationally and used by several provinces consists of currently.*	●				
5	**Key effects of new distribution module.** Effects of the outgoing and new distribution scenarios on key matters: extent of forced multi-grade teaching; maximum class sizes; classroom shortfalls. [A few tables.] *Purpose is to make fully transparent any changes brought about by the next post distribution to: (1) the multi-grade teaching situation; (2) maximum class sizes; and (3) the distribution of classroom shortfalls. This may influence parameters used in the generation of the new distribution.*	●			●	● ❍
6	**Instability effects module.** Instability effect of replacing one distribution scenario with another, taking into consideration inter-school movement of educators. [Some key tables.] *Purpose is to balance the need for a fair distribution of posts with the need for stability in the schooling system.*					● ❍
7	**School form module.** Simulations per school of possible class sizes, multi-grade teaching (if applicable), and possible FET subject diversity. The number of mathematics teachers all schools with FET should have would also be specified. [One highly readable sheet per school explaining both what is provided to the school, and how the posts may be utilised. Also summary tables with aggregates for whole province.] *Purpose is to communicate to schools what can be done, or is expected to be done, with the new year's post establishment. This can serve as an opportunity to reinforce what the policy is on matters such as the curriculum and teaching time..*	●				❍

8.3 Implications for other policies

Whilst the main intention of this report is to inform the revision of the post provisioning norms, it would be correct to point out possible implications of the analysis for other education policy areas.

- **Conditions of service for educators.** Section 4.7 of this report indicated that one would expect the number of publicly employed educators to exceed the number of classes at the primary level by around 6%. In reality, the figure is around 18%. This means that more time is spent on activities other than teaching, than one would expect, given the policies. This could partly be because schools are dealing with problems on the ground rationally, and spending more time on management than policy envisages, or more time on work other than regular teaching (for instance offering support to smaller groups of learners). Should the policies under-estimate the time educators should spend on activities other than regular teaching, then this should be corrected. Without such a correction, the assumptions around likely and possible class sizes in the schooling system will be incorrect.

- **Restructuring of schools.** The structural peculiarities of the schooling system in EC, in particular the extent of small schools and small grade groups under 35, makes delivering education in this province particularly costly. It might be argued that merging of small schools is the answer. This could be investigated, though making a real difference to the underlying structural problems is perhaps impossible in the next ten years, given the difficulty of merging schools, introducing compensatory scholar transport systems, and so on. Arguably the especially difficult situation in EC with regard to school and grade size (referred to repeatedly in section 4) is best dealt with through stronger support for, firstly, multi-grade teachers and, secondly, teachers teaching exceptionally large classes.

- **Classroom construction.** Clearly, more classrooms are needed. This is not a new matter, but the analysis provides what may be some new perspectives on the problem. The shortfall, according to this analysis, is just under 50,000 classrooms. However, that is an under-estimate in the sense that *existing* educators who (according to the policy prescripts) we can regard as full-time teachers are used to gauge what the number of classrooms should be. Certain schools have problems attracting teachers, though they have posts, and in these schools the classroom shortfalls are likely to be under-estimated. It is important to link the demand for classrooms to the post provisioning model, and to simulations of the likely number of classes that should exist in individual schools. Moreover, it is important to rely not only on reports from schools themselves of the classroom shortfalls. Given that teachers are generally under-utilised (in schools with and without classroom shortfalls), it is likely that schools will under-estimate the number of classes there ought to be in the school, and hence also the number of classrooms needed.

- **GET curriculum.** There is no mention of multi-grade teaching in the principal GET curriculum guideline documents. This is perhaps surprising, given that 5% of learners and 30% of schools must necessarily engage in multi-grade teaching, by virtue of the fact that there are more grades than educators in the school (see section 4.6). Clearer curriculum guidelines on multi-grade teaching and learning at the GET level are required. It is probably also important for curriculum support staff in the PEDs to obtain a clearer picture of *which* schools are forced to have multi-grade teaching. Current datasets do allow us to obtain this information.

- **FET curriculum.** The existing post provisioning model and the existing distribution of educator posts across schools offering Grades 10 to 12 does make offering the new FET schools curriculum possible. In other words, there is not really a problem in terms of the number of educators. The problem would lie in the qualifications, knowledge and skills of existing educators.

- **School management.** Even where classroom shortfalls are not a problem, Principals are allocating fewer teachers to classes than one would expect, given the policies. It seems likely that better support is needed for Principals in terms of timetabling, and in enforcing the minimum teaching hours of teachers.

- **District management of school admissions.** The fact that a shortfall of around 50,000 classrooms should exist whilst 100,000 classrooms are under-utilised (though provisos have been mentioned in this regard in section 4.10, as classrooms may be used for functions other than class teaching), suggests there is scope in some districts to manage inter-school migration within the district better. Note, however, that this analysis did not examine the extent of per school classroom shortfalls and excesses *within* districts.

8.4 Budgetary implications

- **Financing support staff in schools.** The problem of inadequate non-educator posts in schools is partly a matter of an unequal distribution of posts across schools, and partly insufficient spending in this area. A rough assessment of the situation as reflected in section 4.9 (specifically Table 27) suggests that provinces should aim to spend sufficiently to reach an L/N ratio of 160 learners per non-educator at the aggregate provincial level. Currently, six provinces are above this level. For all provinces to reach a minimum L/N ratio of 160 entails increasing annual spending by R2.6bn nationally (the highest provincial increase would be that of KN, at around R800m).

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