

Generation and use of data in KwaZulu-Natal in the delivery of basic education

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EXECUTIVE SUMMARY

The current report forms part of a larger project examining **problems and solutions in the collection and use of data in provincial education systems** in South Africa. This report focusses on KwaZulu-Natal's schooling system. It accompanies a similar report dealing with Western Cape.

This executive summary captures highlights from the report. Beyond the executive summary, the reader is urged to consult, above all, **section 3, which provides a high-level assessment** of KwaZulu-Natal Department of Education's (KZNDoe) success in improving service delivery through the effective use of data. This section is important because so many of the department's challenges in the area of data and information systems are not about specific system adjustments, but about the way the organisation as a whole approaches the question of data use. Of course, the specifics are important too and the report pays considerable attention to this. Here the reader is encouraged to pay particular attention to the **'Way forward' boxes appearing in section 4**.

Beyond the current report, a **summary report** drawing from both the Western Cape and KwaZulu-Natal analyses is intended to provide guidance to all nine provinces in the area of data systems and use.

This KwaZulu-Natal analysis draws largely from interviews with KZNDoe **head office officials**, but also a few district- and school-level interviews conducted to verify responses provided by head office officials. Moreover, extensive **document and data analysis** occurred.

Ironically, limited capacity to analyse learner performance data in KZNDoe has for many years hidden the fact that KwaZulu-Natal is **a relatively good performer in the South African context**. In particular, a narrow focus on the Grade 12 'pass rate' (passes over all examination candidates) has detracted from the fact that an exceptionally large percentage of youths reach Grade 12 and that passes relative to the *youth population* puts KwaZulu-Natal in the second or third position amongst South Africa's nine provinces. This is confirmed, whether one looks at Stats SA household data or data from the education system (see section 3). Standardised test data from Grade 6 suggest that even at the primary level, KwaZulu-Natal's performance is relatively good. KwaZulu-Natal, like other provinces, faces considerable education service delivery challenges. What the trends highlighted in the current report suggest is that with better use of data, the province would be in a better position to identify accurately its most pressing problems, and also target its interventions more strategically.

Though there are a number of skilled and committed planners in KZNDoe, and information systems progress seems to be happening, for instance with respect to the SA-SAMS¹ school management system, **KZNDoe's environment is on the whole not conducive to good planning work using data**. In a nutshell, it appears as if the organisation's planning and activities do not acknowledge the centrality of data and information systems for running a schooling system. The basic infrastructure of computer servers, personal computers, networks and e-mails is inadequate. This frustrates many employees. Moreover, the organisational culture is characterised by strong 'silo effects' (sections not working collaboratively when they should). Effective long-range planning in general, and specifically in relation to information systems, is too often lacking. All these constraints stand in stark contrast to the more enabling environment found in the Western Cape department.

¹ South African School Administration and Management System.

KZNDoE would benefit from **‘deeper’ data analysis** of its raw microdata. The current report explains this in terms of available data on individual payments on the payroll system and the marks of learners in individual subjects. These are examples of missed opportunities. More examples could easily be identified. More in-depth analysis of raw data would permit better monitoring of strategically important issues such as unit costs and subject-specific problems in schools.

Six elements of success observed in Western Cape seem useful headings under which to organise possible organisational improvement strategies for KwaZulu-Natal. The six elements are: (1) effective leadership; (2) accurate monitoring of learning outcomes; (3) harnessing web-based technologies; (4) building a strong organisational centre; (5) Responding incrementally to specific operational needs; and (6) respecting the agency of school principals. Section 3 makes recommendations under all six headings.

Section 4 proceeds to examine KZNDoE’s challenges in more depth with respect to specific parts of the system.

Much emphasis is placed on the use of **Grade 12 examinations data**, as the quality of these data and their strategic importance seem to justify prioritising them. Much effort in KZNDoE goes into producing a series of reports using the data. These reports focus to a large degree on traditional ‘pass rate’ indicators, meaning dropping out before Grade 12 is not taken into account (and thus the successes of the province referred to above, which are related to *low* levels of dropping out, are not acknowledged). Moreover, as in most the country, little attention goes towards the attainment of subject-specific thresholds regarded as important by universities. As in Western Cape, there is a need to devise **better school-level indicators of performance** which focus on, for instance, the university-readiness of learners. Moreover, the results of part-time examination candidates need to be accounted for in better ways, and school performance needs to some extent to be viewed relative to socio-economic status. The current report presents concrete examples of how the available data could be better utilised.

With regard to the vital area of **standardised assessments below Grade 12**, and in particular at the primary level, the system is currently awaiting the outcome of the national assessments re-design process, a process which involves all key stakeholders. The re-introduction of standardised assessments is of course crucial for educational improvement to be monitored, and for proper accountability mechanisms to work as they should. For the re-introduced testing to evolve in a manner that supports progress, and to avoid the breakdowns of trust seen in the past, capacity must be built at the provincial and national levels **to understand how other countries have resolved a range of technical and communication problems in this area**. The recommendations made in this regard in the Western Cape report are relevant for KwaZulu-Natal too.

The collection of **‘EMIS data’ on individual learners and teachers** from schools is changing in 2017, from a survey-based approach to one where individual electronic records are transferred from the school to the department, using physical media such as memory sticks. In some ways, it is a pity that the technology for the web-enabled transfer of data out of the school was not ready in time for this transition. Another change will thus occur in the coming years, towards the web-enabled transfer of data. The sooner the modalities of this are clarified, the better, as this has implications for the long-term staffing of offices. EMIS data, like other data, should be used to a greater degree for planning. **A greater variety of analytical reports** should be produced by the provincial EMIS section, which should be adequately resourced for this work.

Whilst the financial accounting systems of government serve financial planning in KZNDoE well, the **school funds of the almost 6,000 schools fall outside the ambit of government’s systems**. From a school effectiveness perspective, a key fact is that around half of schools

manage state funds intended for textbooks and other educational materials themselves, whilst half do not. A key dataset in this regard is the **list of financial functions enjoyed by schools**, functions which according to policy should be determined on the basis of objective evaluations of school management capacity. Analysis presented in the current report indicates that the functions a school enjoys depend to a large degree on which district one is in. This matter warrants further investigation, in particular given that schools often argue that the withholding of functions complicates the management of the school.

Details on the organisational culture problems in KZNDoE receive considerable attention in the section dealing with human resources data, given the budget and service delivery implications of not managing the workforce properly. Undue political factors, including teacher union pressures, do undoubtedly detract from a data-driven planning approach and commitments to spend within budgets. The extent of this problem would be better understood if KZNDoE **conducted opinion surveys of the kind conducted in Western Cape**.

Skills transfer and mentoring in the area of data analysis is not embedded within the organisational culture as it should be. Instead, for its data work the department relies to a large degree on a few individuals working in relative isolation. Thinking around information systems development is largely seen as something the State Information Technology Agency (SITA) must deal with, yet officials are frustrated with the quality of services provided by SITA. The solution here is probably for KZNDoE to ‘in-source’ more of the planning and monitoring elements in its relationship with SITA, to reduce gaps between original intentions and the final product. Put differently, KZNDoE needs **smarter contracting with SITA**.

On a more technical level, the current **context of budget austerity** has magnified the need for accurate monthly monitoring of trends in personnel spending, attrition and hiring. Without this monitoring, actual (as opposed to planned) cost-cutting can be directed at the wrong things and the damage to service delivery can be greater than it should be. In this regard, cleaning up school identifiers on the payroll system will make it easier to ensure that cost-cutting is shared equitably across schools. Performance management system (IQMS) data on individual teachers is barely analysed, yet it should be as patterns in the data provide indications of which schools (and school principals) take the quality of teaching more or less seriously. There are many areas where better data analysis is needed, so there is a real risk that the focus to improve the situation will be spread too widely. The current report proposes concentrating on **establishing ‘pockets of excellence’**, which even top management would pay attention to for some years. Getting employee unit costs right seems one area which should become a ‘pocket of excellence’. If top management insists, for some years, on deeper and more strategically focussed analysis in a few key areas, this is likely to have a knock-on effect on data analysis in general.

Section 5 discusses briefly the problem KZNDoE’s extremely limited capacity to **conduct research in a manner that ensures that its vast datasets are used to produce valuable knowledge** that can guide decision-making. In this regard, it is worth keeping in mind that the schooling system in KwaZulu-Natal is about as large, in terms of enrolments, as that of the median African country. The size and complexity of province’s schooling system seems to warrant a substantial province-level research function. Crucially, a research unit would need to cut across the various ‘silos’ of the department, and should see as its responsibility to analyse, for example, payroll, EMIS and examinations data in an integrated fashion.

Finally, the current report includes three appendices which provide concrete examples of how data could be used to understand, in particular, **Grade 12 examinations trends** and the **unit costs of employees**.

List of acronyms

AG	Auditor-General
ANA	Annual National Assessments
ASS	Annual Survey of Schools
BAS	Basic Accounting System
BI	Business Intelligence
CAPS	Curriculum and Assessment Policy Statement
CEMIS	Central Education Management Information System
COA	Chart of accounts
DBE	Department of Basic Education
ELRC	Education Labour Relations Council
EMIS	Education Management Information System
EPRE	Estimates of Provincial Revenue and Expenditure
GHS	General Household Survey
IIEP	International Institute for Educational Planning
IQMS	Integrated Quality Management System
KZNDoe	KwaZulu-Natal Department of Education
LURIS	Learner Unit Record Information Tracking System
NEEDU	National Education Evaluation and Development Unit
NSC	National Senior Certificate
SACMEQ	Southern and Eastern Africa Consortium for Monitoring Educational Quality
SAIC	School Assessment Irregularities Committee
SA-SAMS	South African School Administration and Management System
SBA	School based assessment
SITA	State Information Technology Agency
Stats SA	Statistics South Africa
TIMSS	Trends in International Mathematics and Science Study
TVET	Technical and vocational education and training

1 Introduction

The current report has been produced as part of a project examining the use of data in two South African provinces, **KwaZulu-Natal** and **Western Cape**, to support service delivery in schools. The inception report for the project provides details on the project design². The project is titled '*Assessment of education department data use in provinces and the formulation of recommendations aimed at improving systems and service delivery outcomes*'. The scope of the project can be described as 'data generation and use', where 'data' means databases, and not, for instance, digital materials used in the classroom for teaching and learning. The inception report moreover explains that the products of the current project, including the current report, are primarily aimed at officials in Treasury, both national and provincial, the national Department of Basic Education and the nine provincial education departments. Thus the two provinces are used as case studies from which a wide range of stakeholders can learn, the aim being to arrive at specific solutions which can accelerate the move to quality service delivery driven to a greater degree by effective data use.

The current report should be read in conjunction with a **similar report on Western Cape**, which was produced prior to the current report. Many important concepts and annual processes applicable nationally are explained in the Western Cape but not repeated in the current report. This is in part to encourage readers of this report to consult the Western Cape report, a key aim of the project being to bring about learning across provinces. (The Western Cape report encourages readers of that report to consult the current report.)

Importantly, the scope of the report is the approximately 5,900 **public ordinary schools** in the KwaZulu-Natal. The focus is thus not on the approximately 250 independent schools in the province, or the 79 public special schools. These other groups of schools would fall within many of the systems described in the current report, but their experiences and circumstances would be different.

The current report is structured as follows:

- Section 2 outlines briefly the process of interviews held with KwaZulu-Natal officials and how the researchers approached the task of preparing the current report.
- Section 3 provides a **high-level description** of the **organisational culture** and **human capacity** which guide and support the use of data in the management and planning of schools in KwaZulu-Natal.
- Section 4 describes how the KwaZulu-Natal Department of Education (KZNDoe) uses data under seven headings: (1) Grade 12 examinations; (2) Pre-Grade 12 assessments; (3) Learner participation data; (4) Finance data; (5) Human resources and payroll data; (6) Physical infrastructure data; (7) Learning materials data. Sub-sections (1) and (5) are relatively long as Grade 12 examinations data and data used for human resources planning were identified as priorities within the current project.
- Section 5 briefly discusses the potential use of the various data sources of KZNDoe for more in-depth research aimed at understanding how educational improvement is brought about and what to focus most on in the coming years.

2 How the current report was produced

The report draws to a large extent from **three days of interviews** with senior officials conducted at the head office of the KwaZulu-Natal Department of Education in

² The seven-page inception report is dated 18 May 2016.

Pietermaritzburg and Durban in August 2016. A project link person in the department identified officials who would be relevant for the interviews, using a list of topics to be covered. Interviews were mostly small, often with just one interviewee at a time. It was made clear to interviewees that no names would be mentioned in the current report, and that as far as possible the two researchers (Dr Martin Gustafsson and Dr Nick Taylor) would ensure that it would not be possible to link specific opinions reflected in the report to individual interviewees. These measures were adopted in order for interviewees to be as frank as possible. Interviews were guided by questions relating to the interviewee's area of focus, but interviewees were encouraged to discuss any issue they thought was relevant for the project, and new questions arose as interviews proceeded.

The report moreover draws from **interviews conducted at seven schools** in the province, where these schools were a mix of primary and secondary schools. Schools were selected by the researchers, and can be considered fairly typical of schools in the province as a whole. Moreover interviews were conducted with officials in the **two district offices**. Whilst such interviews can obviously not produce information representative of the entire province, they served as vital checks on information provided by officials at KZNDoE's head office, and led to important revisions and nuancing of the originally collected information.

The current report also draws from a number of documents: **a literature review** produced for the current project (that review includes an analysis of the 2014 and 2015 annual reports of KZNDoE); documents and tools provided by interviewees; various additional reports which seemed informative for the analysis.

There is a strong emphasis in the current report on making explicit what data and statistics are **publicly available on the Web**. When these things are available on the Web, the scope for their use obviously widens considerably. Parents, accountability structures and researchers then get to access information they may otherwise not have had.

The following questions guided the writing of the current report:

- What are the **basic details** of existing systems, policies and institutions which underpin the availability and use of data in KZNDoE? In particular, the focus was on data whose use does or could enhance service delivery and in particular improvements in educational outcomes.
- What **problems** do officials see in the existing systems, and what problems do the researchers see? What problems do schools experience? What are the best next steps and also the optimum long-range vision with respect to taking existing systems forward, in the opinions of the officials and researchers?
- What are the **lessons** for education systems in general, but South Africa's provinces specifically, which could be drawn from the past experiences of KZNDoE?

Systems of the kind described in the current report are of course dynamic. Procedures change over time. As far as possible, the current report focusses on systems as they existed in 2015 and 2016. When the report was being compiled, the 2016 school year was not completed.

3 A high-level description of KZNDoE, its data and service delivery

Several aspects of the schooling system in KwaZulu-Natal should inspire hope. Whether one uses data from the education administration or Stats SA household data, a picture emerges of a system that is particularly **good at getting youths to successfully complete the full cycle of twelve years of schooling**. In fact, according to some measures only Gauteng gets a higher proportion of youths to complete Grade 12 (this is discussed in section 4.1). What is striking

is how unknown this positive aspect of the province is. Even at levels below Grade 12 the province performs relatively well in the South African context. Credible research indicates that relative to certain measures of socio-economic disadvantage, Grade 6 mathematics performance in SACMEQ³ in KwaZulu-Natal is surpassed by that of just two other provinces: Western Cape and Gauteng⁴. Put differently, for learners at any specific level of home background advantage, KwaZulu-Natal is the third-best province to be in with respect to education service delivery.

Interviews with officials in the KZNDoE head office confirmed that the department includes some exceptionally **talented, skilled and committed people**. In this sense KZNDoE is similar to the department in Western Cape. To illustrate, considerable effort and thinking goes into using data to produce a variety of reports aimed at districts and schools after each year-end Grade 12 examination. The couple of schools visited revealed that these reports do reach schools and are taken seriously. Though these schools cannot represent schools in general in the province, it is encouraging that in the two schools (which were selected by the researchers, not KZNDoE), staff were optimistic about the current and planned functionality of the SA-SAMS⁵ school management system. In particular, the ability of this system to improve the management of learner assessment and grade promotions was acknowledged.

Yet despite points in its favour, KZNDoE also clearly displays organisational culture problems which seriously limit the degree to which an enabling environment needed for work with data can come about. In this respect, KZNDoE stands in stark contrast to the department in Western Cape. It became clear during the interviews with head office officials that **the centrality of data and information systems is not recognised as it should be**. It seems the basic infrastructure of computer servers, personal computers and networks is inadequate for the work that must be done. Many officials do not use their official e-mail addresses due to concerns that e-mails disappear. These problems are discussed in section 4.5. It is understandable that staff in KZNDoE should appear more frustrated and less satisfied than their counterparts in Western Cape. Less infrastructure-related organisational culture problems include strong 'silo effects' (different sections working in isolation from each other when they should collaborate). Three critical elements of sustainable and meaningful planning are often absent. These three elements are: carefully thought out initial plans; an acceptance that plans need to be adjusted as lessons are learnt; and a sustained focus, possibly spanning several years, on achieving specific outcomes. Western Cape's successes in the area of information systems have relied strongly on the presence of these three elements of planning.

Whilst the data that are analysed in KZNDoE are relatively detailed, opportunities for monitoring and understanding the schooling system are lost because the raw microdata are not analysed by at least a few people in the department. A similar criticism can be made of the department in Western Cape. To illustrate, analysis of payment records (not just employee records) in the Persal payroll system, or analysis of individual learner and subject marks in the examinations system, would allow KZNDoE to answer a much wider range of important policy questions relating to, for instance, the trends in the uptake and cost of employee benefits, and the degree to which individual subject teachers in specific schools are teaching exceptionally well or poorly. **Moving to 'deeper' data analysis** would require expanding the skills set of a few people and acquiring new software, specifically statistical analysis software.

³ Southern and Eastern Africa Consortium for Monitoring Educational Quality.

⁴ See Wills, Shepherd and Kotze (2016: 15). The measure of socio-economic disadvantage referred to here is household consumption. If household assets are considered, KwaZulu-Natal's performance become more average amongst the nine provinces.

⁵ South African School Administration and Management System.

The Western Cape report attributes the relative success of that province's education department to **six critical elements**. Those six elements are listed below, and for each suggestions are made around how progress could be made in KwaZulu-Natal.

1. **Effective leadership.** As discussed above and the rest of the report, the centrality of information systems and data in an effective education administration needs to be clearly recognised and promoted.
2. **Accurate monitoring of learning outcomes.** Here bringing about a better understanding amongst all KZNDoe managers of the strengths of the province's schooling system is vital. As is argued strongly in the current report, a narrow focus on a few traditional indicators has prevented a proper understanding of the education being produced by the system. If strengths, but also weaknesses, in the system are not properly identified, efforts to improve the system are less likely to be targeted at the right things.
3. **Harnessing web-based technologies.** There are signs that the province may be approaching a 'take-off' in this area, in particular if national plans to make SA-SAMS a web-enabled system proceed (see section 4.3). However, there are several challenges that will need to be addressed. In particular, better contract management in the inevitable relationship between KZNDoe and the State Information Technology Agency (SITA) is vital (see section 4.5).
4. **Building a strong organisational centre.** As discussed in various places in the current report, a clearer understanding of the dynamics of the system amongst leaders and top managers in the organisation is needed. This understanding must be built partly through better analysis of the available data at the KZNDoe head office. Moreover, it is built by regular contact between top decision-makers and more technical staff, who should be learning from each other. These developments are pre-requisites for a strong and respected 'centre' in the KwaZulu-Natal schooling system.
5. **Responding incrementally to specific operational needs.** The Western Cape Education Department made progress in the area of information systems development by, in a way, addressing specific needs one by one. Whilst its piecemeal approach is open to criticism, this approach has also protected the Western Cape department from the risk of overly ambitious systems projects which are 'set up to fail'. Failure of this kind is notoriously common around the world in e-government projects. In the current report what is promoted is the building of 'pockets of excellence' around data use in specific parts of the KZNDoe, which can serve as examples to the organisation as a whole of what is possible and what skills are needed.
6. **Respecting the agency of school principals.** The literature is rather clear that empowering school principals is important for improving the effectiveness of schools. But what is also clear is that this must be accompanied by good monitoring systems that make it clear which schools are improving over time, and therefore warrant a 'hands-off' approach, and which schools need some kind of intervention from above. South Africa is still many steps away from having effective monitoring systems of this kind. In the case of KwaZulu-Natal, it seems sensible to build on the current feedback systems using Grade 12 examinations data, in a way that brings about more meaningful, sufficiently easy-to-understand and fair indicators of school performance and progress. This recommendation would also apply to Western Cape. Concrete suggestions in this regard are provided in both the current report and the Western Cape report.

To sum up, whilst KwaZulu-Natal delivers basic education relatively well in the South African context, and probably better than most KZNDoe managers realise, KZNDoe urgently needs improvement in a few basic and important areas. The data utilisation problems

discussed above are in fact relatively easy to solve in the space of, say, two to three years, so **this is change that ought to be embraced**. These changes would put KZNDoE in a far better position to tackle the really important change that must happen, and that is of course to raise the literacy, numeracy and other skills of learners to levels seen in developing country schooling systems outside South Africa.

4 Parts of the KwaZulu-Natal system

4.1 Grade 12 examinations

Apart from data emerging from the main Grade 12 examinations systems, KZNDoE also has data, collected separately, from a number of **‘common tests’ conducted in grades 10 to 12** aimed at preparing schools for the final Grade 12 examinations. The common tests have covered 13 key subjects, including two languages, and have been compulsory only for schools with a relatively poor Grade 12 examinations track record. Roughly, around two-thirds of schools participate in the common tests. The common tests seem to be valued by schools, though there have been concerns around the quality of test papers. It seems as if these concerns are a part of the reason why at least better performing schools are given the option of using the provincial tests, or tests set by teachers at the school. Common tests are marked by teachers in schools, after which aggregate school-level statistics are submitted to the department, which uses these statistics for a number of reports (see description below).

As in the other provinces, in KwaZulu-Natal the Grade 12 examinations data are highly accurate, given their high stakes, and for officials with permission to access the raw microdata, the data are fairly easily obtainable, though they tend to access data aggregated to the school level. A concern in KZNDoE has been the extent of missing **13-digit national identity numbers for learners**. As seen in Table 1 below, 4% of learners in the 2015 examinations data do not have the 13-digit national number, but this problem is not unique to KwaZulu-Natal. The 13th digit of the number is a check digit which is meant to follow an algorithm. An analysis of the 2015 examinations data revealed that 0.4% of all examination candidates in KwaZulu-Natal have an invalid 13th digit. The extent of the problem is similar at the national level. Analysis of the 2014 examinations data revealed patterns similar to those seen in Table 1.

Table 1: Problems with 13-digit national identity number in the 2015 examinations data

	% missing	% with invalid 13 th digit
EC	8	0.6
FS	2	0.1
GP	4	0.2
KN	4	0.4
LP	1	0.1
MP	3	0.2
NC	3	0.1
NW	1	0.1
WC	4	2.2
SA	4	0.4

Both department officials and school principals believe that **cheating** in the year-end examinations is a major problem which needs to be tackled. As discussed below, some of the department’s analyses of the data are aimed at detecting which schools are guilty. Procedures and structures such as the national School Assessment Irregularities Committee (SAIC) have been set up to combat cheating and are considered in KwaZulu-Natal as partially effective, though in need of some change. In particular, it is felt that lessons from past irregularities

should influence current actions more directly, and monitoring of trends over time should occur so that a better sense is created of whether there is progress.

In KwaZulu-Natal, unlike in Western Cape, there is no provincial collection and analysis of **year-end examination results below the paper level**. There are thus no reports with statistics on how well, say, schools did in specific questions of specific examination papers. However, the DBE has for some years managed the data capturing of question-level marks in key subjects in small samples of papers per province. Specifically, it seems as if around 100 papers per province in key subjects are selected randomly, and that question-level marks are then entered into Excel tools. To date, no reports have emerged using these data, in part due to capacity limitations in the DBE.

A few KZNDoE reports using the Grade 12 examinations data, aggregated to the school level, were received by the researchers and examined. Five reports are described below.

- A 45-page **review of performance in the 2014 year-end examinations**⁶, with a special emphasis on subjects and districts which require attention, because they appear to have contributed significantly to declines. The report includes summary statistics and extensive narrative. It also proposes a division of labour amongst districts for work on developing provincial materials to help teachers and learners deal with difficult topics. The report acknowledges that the first ever use of the CAPS⁷ documents to guide teachers and even the design of examinations in 2014 made this year a particularly difficult year. Appendix A of the current report (see below) explores ways in which the examinations data could be better used in future to tackle the monitoring questions dealt with in KZNDoE's report. In fact, Appendix A argues that without a more comprehensive analysis, it is easy to classify areas of the province, such as districts, to be deteriorating when in fact they are improving.
- A 90-page district-specific **report with statistics at the level of the school and subject**, with all statistics focussing on number of candidates and passes at the 30% mark level. The report contains just tables, not any narrative. Performance in the 2015 year-end examination as well as performance in the March 2015 'common tests' is reflected. Targets per subject and school for the 2016 year-end examinations are proposed. These targets are essentially the 'pass rate' (passes over candidates) from the 2015 year-end examinations with ten percentage points added.
- A 33-page report with just **tables comparing every school's mathematics pass rate in 2014 to that of 2015**, with schools sorted by the size of the decline in the pass rate across the two years. The first school in the list is thus one which saw an increase from 0% passes to 100% pass, whilst the last school saw a decline from 100% to 0%. The trends in the report are thought to reflect, in part, irregularities in the administration of the examinations, and the report is thus partly intended to assist in the detection of irregularities and even fraud.
- A 35-page report very similar to the one mentioned above, though here the **emphasis is on the overall pass rate of the school** in the two years. Appendix B of the current report explores ways of strengthening this type of analysis, but also finds that there are no strong reasons to believe that unusually high overall pass rate increases in individual schools in KwaZulu-Natal are more prevalent than in other provinces.

⁶ KwaZulu-Natal Department of Education, 2015. The title of the report is: *National Senior Certificate: Accurate lessons from the performance of the "Class of 2014"*.

⁷ Curriculum and Assessment Policy Statement.

- A 40-page report with just **2015 year-end mathematics results**, three statistics per school: the number of learners writing the mathematics examination, the number passing, and the pass rate (the second value divided by the first). This report is partly intended to assist in the interpretation of the 2014 to 2015 comparison report mentioned two bullets above.

The source data for the abovementioned reports are school-level results provided to provinces by the DBE. It is possible for KZNDoE to acquire **learner-level data**, which would of course provide opportunities for far more in-depth analysis. However, these raw data are seldom obtained, in part because of limited capacity within KZNDoE to use such data. Very specifically, much of KZNDoE's examinations data analysis occurs in Excel, which is inadequate for the analysis of learner-level records for two reasons. Firstly, Excel is not good at handling the volume of data implied by learner-level records. Secondly, a key reason why one would want to use learner-level data, is that that one is then able to examine learner-level correlations across subjects. Linking learner records in one subject to learner records in another subject through a learner unique identifier would be virtually impossible in Excel. Ideally, KZNDoE should have data analysts able to work in either Microsoft Access or, preferably, a statistical package such as Stata or SPSS.

Interviewees in district offices and schools revealed that at least some of the abovementioned **KZNDoE reports are known down to the level of the school principal**. School-level targets in the reports seem to be taken seriously by schools. However, schools indicated they would like to see a broader focus with regard to these targets, beyond just passes. How this need could be satisfied is in part the focus of Appendix A below.

There seems to be a **need for far more nuanced analyses of Grade 12 examinations data**. The very strong focus on basic pass rates means that performance at higher levels, but also educational achievement relative to the total population, become unclear. A key matter that is understood by very few in KZNDoE is that the province is rather good at ensuring that youths obtain the NSC, despite the low official pass rates in the province. With regard to the latter, KwaZulu-Natal has been the province with the second-worst pass rate in the country in three of the four years 2012 to 2015 (in 2013 KwaZulu-Natal was four positions from the bottom)⁸. Moreover, the trend in the pass rate has clearly been downward for KwaZulu-Natal for the four years. These trends are widely considered to be indicative of a province that performs poorly, and is worsening. National Treasury reports, like those of the education departments, put the pass rate at the centre of the discussion around Grade 12 outcomes. For instance, Treasury's 2014 review of provincial performance looks mainly to Grade 12 pass rate trends to gauge progress in the schooling sector⁹. Alternative and more accurate indicators such as South Africa's TIMSS¹⁰ score in Grade 9 mathematics and science have received very little attention¹¹. There has been considerable criticism, including within the academic literature, of the very strong focus on South Africa's pass rates, but this criticism has in the past had little impact¹². There are indications now, however, of a stronger interest in a wider range Grade 12 indicators which would cover more issues of importance for national development. For example, indicators in government's Medium Term Strategic Framework (MTSF) have since 2014 covered mathematics learners achieving 50% (so a level above the basic pass level of 30%), and the number of overall Grade 12 passes relative to the youth population¹³.

⁸ Department of Basic Education, 2016a: 43.

⁹ National Treasury, 2014: 45.

¹⁰ Trends in International Mathematics and Science Study.

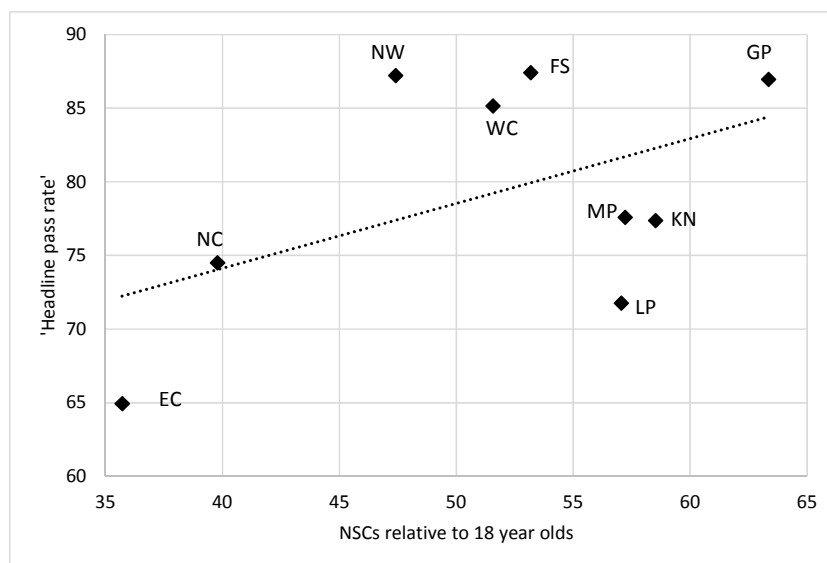
¹¹ Reddy *et al*, 2012.

¹² Taylor, 2009: 6.

¹³ Appendices to Presidency (2014).

Figure 1 below, taken from a DBE report¹⁴, illustrates how the overall Grade 12 pass rate can be deceptive, especially for a province such as KwaZulu-Natal. The vertical axis confirms KwaZulu-Natal's low ranking when it comes to the pass rate. (The graph illustrates the situation in 2013. Had 2012, 2014 or 2015 been used, the situation would have looked even worse for KwaZulu-Natal.) The horizontal axis, on the other hand, displays **NSCs obtained as a percentage of the estimated number of 18 year olds** in 2013. According to this indicator KwaZulu-Natal does very well, second only to Gauteng. This would occur if KwaZulu-Natal were particularly good at ensuring that youths did not drop out of school before Grade 12.

Figure 1: Different 'pass rates' in 2013

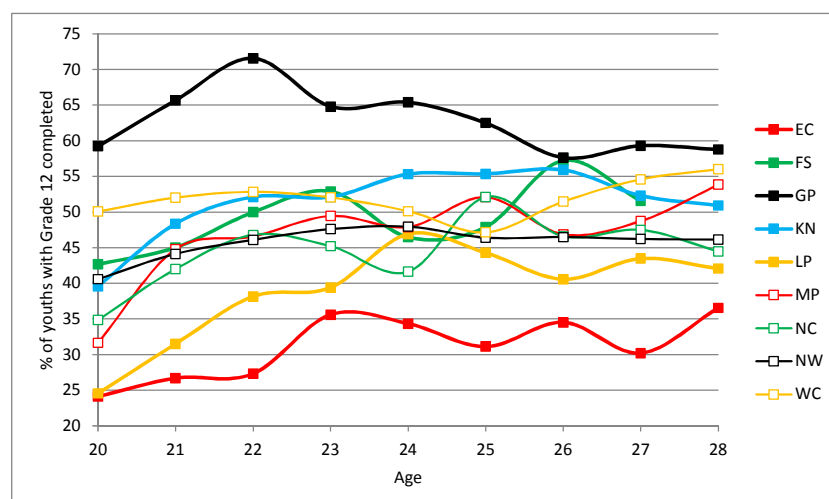


Note: The horizontal axis represents an indicator where an enrolment-derived population estimate is used as a denominator, whilst the vertical axis refers to official pass rates (NSC passes over candidates who wrote the examination) as published in the official examinations report for 2013 of the DBE.

The population estimates used for the above graph are derived from several years of DBE enrolment by age data, combined with Stats SA household data on enrolment levels for children aged 15 and below. This approach, it is argued in the DBE report, is preferable to the use of official Stats SA population estimates, which deviate from enrolment figures in ways one would normally not expect. The correctness of the picture seen in Figure 1 is confirmed by Figure 2, which uses only **Stats SA household data**, and no DBE enrolment data at all. Figure 2 shows that the percentage of youths with the NSC in KwaZulu-Natal across the ages 20 to 28 has been exceptionally high, in certain ages surpassed only by Gauteng.

¹⁴ Department of Basic Education, 2016b.

Figure 2: Youths having completed Grade 12 in GHS (2013-2015)



Source: General Household Survey datasets.

Note: Each point in the graph is the average across the three points for 2013 to 2015. In the case of KwaZulu-Natal, the confidence interval for any single point is around 3 percentage points either way. This means that where the province's value is 55%, we can be 95% certain that the true value lies in the range of 52% to 58%. Something similar would apply to all provinces.

The 2015 year-end examinations were the first examinations where **learners were classified as either 'progressed' or 'non-progressed'**. Progressed here means promoted to Grade 12, from Grade 11, although the learner is 'borderline' in the sense that he or she did not fulfil all the formal promotion requirements¹⁵. The 2015 year-end examination results were to some degree disaggregated by 'progressed' against 'non-progressed' candidates, to facilitate comparison to previous years. Clearly an important data matter is the integrity within the examinations system of the variable indicating whether a learner is in the one category or the other. Some analysis indicates that there were noteworthy problems in this regard in the 2015 examinations cycle¹⁶, a problem which has been attributed to the fact that the categorisation was being implemented for the first time.

As is the case in Western Cape, in KwaZulu-Natal the monitoring of Grade 12 outcomes is weakened by the fact that **part-time examination candidates** are to a large degree not included in the statistics. In KwaZulu-Natal, 15% of examination candidates are part-time students, or around 27,000 of 174,000 youths (in 2015)¹⁷. In recent years, the great majority of these students in KwaZulu-Natal have been writing their examinations at a school¹⁸. Both department officials and school principals confirmed that the practice of persuading weaker learners to register as part-time, as opposed to full-time learners, even when enrolled in Grade 12 for the first time, is common.

Way forward

The challenges for KwaZulu-Natal with regard to the Grade 12 examinations data use are similar to those of Western Cape. The organisational capacity for producing province-specific Grade 12 reports following the year-end examinations, so that districts and schools have access to systematic feedback, clearly exists. This is an important point of departure. Much of the challenge lies in the better calculation of **school-level indicators** in ways that take into

¹⁵ Department of Basic Education, 2016a: 11.

¹⁶ Department of Basic Education, 2016c.

¹⁷ Department of Basic Education, 2016a: 18.

¹⁸ Department of Basic Education, 2013: 18.

account **dropping out before Grade 12**, the balance between full-time and **part-time examination candidates** and the **socio-economic challenges** faced by schools. Moreover, like Western Cape, KwaZulu-Natal needs to begin analysing original learner-level data, as opposed to relying just on ‘pre-packaged’ school-level results. This move will permit better assessments of, for instance, which subjects need special attention in individual schools.

4.2 Pre-Grade 12 assessments

What KZNDoe refers to as ‘**common tests**’ are found in grades 10, 11 and 12 (see section 4.1 above) but also in grades 3, 6 and 9. These tests in the lower grades are provincial tests for key subjects, meaning that for other subjects schools must set their own tests. Moreover, using the ‘common tests’ in grades 3, 6 and 9 is only compulsory where schools perform poorly, in terms of their own Grade 12 examination results or, in the case of primary schools, the Grade 12 results of the secondary school into which the primary school feeds. The common tests should be used to replace term- and year-end tests and examinations, meaning the provincial common tests do not represent additional work for teachers. In fact, school interviewees indicated that they were happy with the common tests in part because they alleviated teachers of one task, namely the setting of the tests. Teachers would like to see provincial common tests across all subjects in the affected grades.

Despite the apparent satisfaction of teachers, **teacher unions have opposed the common tests** in grades 3, 6 and 9, and have linked this to their opposition to the Annual National Assessments (ANA). The result has been the refusal amongst teachers to administer the common tests in some schools.

Though data are collected from schools following each conducting of the grades 3, 6 and 9 common tests in schools, these data have **not been subjected to any major quality assurance or analysis**. This is unlike the grades 10 to 12 common test data discussed previously, which are at least used to produce school-level summary statistics within reports which are distributed to schools.

Interviewees in the four schools were asked about their opinions on the **Annual National Assessments**. The interviewees were on the whole not happy with this programme, to a large degree because it was seen to entail additional work which the schools themselves did not benefit from. It was felt that if the ANA tests were considered official term-end tests (for Term 3) which count for a learner’s promotion into the next grade, then schools would see more purpose in ANA. A common view was that ANA was used to judge schools and teachers in an unfair and un-transparent fashion. Indeed, the 2013 report by the National Education Evaluation and Development Unit (NEEDU) found that nationally over half of schools did not receive any documentary feedback at all following their submission of data, and that a worryingly high number of schools which did receive feedback received information which did not tally with the school’s copies of submitted data, for reasons which were not clear¹⁹.

Interviewees at the school and district level openly described serious instances of **cheating in ANA**. It appears as if a range of cheating activities are common. Test papers are distributed to learners before the time of the test, teachers help learners respond to questions during the test, and teachers are known to unduly inflate ANA marks in order to create an illusion of good performance. One relatively simple solution which a number of interviewees felt should be implemented was more monitoring and quality assurance by educators of *neighbouring* schools.

¹⁹ Department of Basic Education, 2013b.

Despite having reservations, many interviewees agreed that having standardised testing below Grade 12, and specifically at the primary level, was **one of several programmes needed if the quality of school education was to improve.**

Way forward

As argued in the Western Cape report, an important prerequisite for progress in the area of assessments is a better grasp in the sector of how successful schooling systems across the world have used test data to determine which schools can be considered exemplary, and which require remedial action. In some respects those who opposed ANA and KwaZulu-Natal's own 'common tests' for grades 3, 6 and 9 were justified in criticising the way the assessments were designed and carried out. However, what is also clear is that progress with respect to learner performance is far less likely to occur if there is no standardised testing. The Western Cape report discusses in some detail **how the knowledge base for taking assessments forward in South Africa can be made stronger.** A part of the challenge consists of learning from Western Cape, which has the longest history, of the nine provinces, in the implementation of standardised testing.

4.3 Learner participation data

In this section learner participation data are covered, but so are the systems dealing with these data (though in many cases these systems also deal with other data): **SA-SAMS, LURITS²⁰, the Annual Survey of Schools (ASS) and the Snap Survey.** The ASS has been run in March of each year, whilst the shorter Snap Survey has been run in January, at the start of the school year. The four systems can be said to constitute the main body of what is considered 'EMIS'²¹ in KZNDoE and across the nine provinces (with the important exception that SA-SAMS is not a part of EMIS in Western Cape). (As argued in the literature review accompanying the current report, ideally 'EMIS' should refer to a wider range of data and systems.)

The basic elements and functions of SA-SAMS were described in the literature review. Above all, it is important to bear in mind that **schools-based data on SA-SAMS are not submitted automatically, via the Web,** to the department. Submission must occur through e-mailed computer files, or some physical device such as a memory stick. In KwaZulu-Natal, as in seven other provinces (all except for Western Cape), SA-SAMS is said to be almost universally used in schools to collect details on learners needed for the national LURITS database. These collections occur four times a year, meaning details such as the movement of learners across schools become reflected in LURITS down to a quarterly level.

Details on the extent to which schools are not able to collect their learner data through SA-SAMS, for instance where the school has no computer and the district must enter data on behalf of the school, are not possible to obtain, but such exceptions undoubtedly exist. Other problems which are likely to arise is loss of data through incorrect use of SA-SAMS or hardware crashes. A 2016 report on SA-SAMS pointed out that the system can be unstable, and that this can lead to data loss. Outdated computers is cited as a widespread problem in KwaZulu-Natal, in the case of schools and even offices of the department. One indirect measure of the effectiveness of SA-SAMS is the percentage of schools with the apparently correct data in the national LURITS database. An analysis of LURITS data for the years 2012 to 2015²² suggests that the SA-SAMS to LURITS 'data pipeline' in KwaZulu-Natal has improved, with the percentage of learners in LURITS as a percentage of learners in the official Snap Survey rising from 86% in 2013, to 90% in 2014, to 95% in 2015. **KwaZulu-**

²⁰ Learner Unit Record Information Tracking System.

²¹ Education Management Information System.

²² Gustafsson, 2016c.

Natal's 95% figure for 2015 was in fact the best across all provinces, with the national figure being 83%.

Of course these values must be 100% for the system to be said to be working. Without a full representation of enrolments in LURITS, LURITS should not be used as a basis for allocating resources across schools. Apart from having all learners in LURITS, what is also important is **ensuring that the same learners in different years have consistent unique learner identifiers**. In KwaZulu-Natal (and Western Cape) officials considered this aspect of LURITS to be functioning well. However, as shown in analysis presented in the Western Cape report, it seems there are noteworthy problems here. The fact that this problem is not picked up seems due to the fact that this key element of the LURITS data (the ability to link across years) is not made use of in any practical way (more discussion on this below).

Importantly, schools are said to be enthusiastic about SA-SAMS, as it currently stands and in terms of its expected enhancements. This was confirmed in the two schools visited. One critique directed at SA-SAMS has been that it has not added enough direct value to the functioning of the school, and has served largely as a tool for submitting data to the department. **A key way in which schools clearly are deriving utility from SA-SAMS is in the area of schools-based assessment (SBA) marks**. KZNDoE requires schools to submit SBA marks through SA-SAMS, but having these data on SA-SAMS in the school allows the school to produce learner report cards and calculate grade-on-grade promotions more efficiently.

However, whilst schools are enthusiastic, they also complain that they do not fully trust the system's automatic calculations on who qualifies to be promoted to the next grade. This could be because the school staff's understanding of how this should be calculated is different to that of the SA-SAMS systems designers. What seems to be a clear problem is insufficient transparency around how SA-SAMS performs this task. Schools seem to see the **process as occurring in a 'black box'** and the documentation one would expect schools to have with regard to the process is not available²³. Moreover, school staff indicated that they would like more assistance in the form of automatic detection of obviously erroneous data entry. A look at the downloadable SA-SAMS manuals reveals that whilst instructions to users seem clear, and in general the manuals appear to be of a high standard, details on the calculations used to determine which learners are promoted are not made explicit. A further issue is that the relevant manual is dated January 2013, but the SA-SAMS website is not clear on the date of the latest available version of SA-SAMS, and whether there might be important discrepancies between the manuals and subsequent updated versions of the system²⁴.

More generally, a look at the SA-SAMS website suggests that standard procedures which would make the work easier for users, and protect their data, ought to be much stronger. To illustrate, there is far **too little guidance to existing SA-SAMS users on how to update their software without losing data**. This is obviously a critical omission. There are training workshops for school staff responsible for SA-SAMS work, but these are not always held as planned. In any event, critical information that users need should be available on the Web.

It seems as the biggest complaint from schools relates not to the SA-SAMS computer software, but to the lack of human capacity to enter and update the data. The ideal is widely

²³ This was a complaint also heard from Western Cape users of the completely separate CEMIS system.

²⁴ The manual consulted is that for Module 12, dealing with 'curriculum related data'. The website is at <http://www.sasams.co.za>. What is worth noting is that installing SA-SAMS involves downloading and then running an initial installation file, and then downloading two further files and installing these, one of which is a patch to update the original installation file. This is rather cumbersome way of installing software and could result in problems for inexperienced computer users. A more efficient approach would be to update the initial installation file for new users, and then to have a patch for use by those who have some time back installed SA-SAMS.

seen as having a clerk in the school to manage SA-SAMS. Where such a person does not exist, schools are pessimistic about being able to manage the system, and expand the use of SA-SAMS even further. These problems are also widely cited in Western Cape. Figures from Table 2 below indicate that **in 2014 49% of primary schools and 64% of secondary schools in KwaZulu-Natal had administration officers** (only public schools are considered in this analysis). 482 schools had more than one such person. The situation seems considerably better in urban areas: in 2014, 75% of schools in Umlazi and Pinetown had ‘admin officers’, with the figure being around 50% for all the other districts except for Sisonke, which had an exceptionally low figure of 30%. As in Western Cape, it is common for schools in KwaZulu-Natal to make use of interns from TVET colleges to work on SA-SAMS data. Schools may still complain about capacity even if they have an ‘admin officer’ as in the case of larger schools, in particular schools which collect school fees, one such person may be left with little time to work on SA-SAMS. Importantly, SA-SAMS is designed as a single-user system. It would be difficult or impossible for a school to set SA-SAMS up on a school network that would allow teachers to each manage their own data simultaneously on the system.

Table 2: Schools and their ‘admin. staff’ situation in 2014

	Primary	Secondary	Total
No staff	1,955	746	2,701
Publicly paid staff	1,603	1,122	2,725
Privately paid staff	48	54	102
Both public and private	225	159	384
Total	3,606	1,922	5,528

Source: 2014 Snap Survey microdata available through the DataFirst data portal. Only public ordinary schools were considered.

As seen in Table 3 below, **KwaZulu-Natal was amongst the three worst provinces when it came to the provision of an administrative officer in 2014** (though 2016 data were not analysed, one can be certain that a similar situation would prevail then).

Table 3: Percentage of schools with ‘admin staff’ in 2014

	Primary	Secondary	Total
EC	29	57	43
FS	51	96	68
GP	98	99	98
KN	49	64	54
LP	23	35	27
MP	75	89	81
NC	85	93	88
NW	88	93	89
WC	92	99	94
SA	54	68	59

Turning to office-based processes in KZNDoE, one common complaint is that SA-SAMS computer files submitted to the department are merged to form provincial files through a **procedure that is relatively ‘manual’ and labour-intensive**. At least three people in the province are engaged in this work on an almost full-time basis. Clearly, an automated and web-enabled merging process would allow staff to spend time on more high-level tasks, such as checking the validity of data, making follow-ups where there are problems and producing reports.

The web-enablement of SA-SAMS is currently being planned by the DBE. As one might expect, this is welcomed by KZNDoE officials.

There is a sense amongst EMIS officials that **EMIS has been under-funded and under-prioritised in KZNDoe**, and that the available EMIS resources have not matched expectations around what EMIS should produce. This perception seems justified. It seems as if past attempts by Treasury to prioritise EMIS through an earmarked grant have been diluted within the KZNDoe, in part because whilst grant funds were injected, previously existing budgets were removed.

However, it also seems as if EMIS officials could have done more to attract funding, by demonstrating potential through the production of specific EMIS products. In particular, there seems to be an absence of a ‘strong centre’ in the form of a team of KZNDoe head office officials able to provide leadership to EMIS officials at lower levels of the system, through reports and a clear understanding of the trends seen in the EMIS data. To illustrate, whilst EMIS in the provincial head office does, it seems, produce an annual statistical report, this is not published on the KZNDoe website, nor is it widely available within the KZNDoe. It could be argued that the existence of the national annual EMIS report, which provides province- and district-level statistics, makes a provincial KwaZulu-Natal report unnecessary. The counter-argument would be that KwaZulu-Natal is large and complex enough to warrant its own report, perhaps a report that exceeds the national report in terms of depth. In this regard it is worth noting that **had KwaZulu-Natal been an African country, its school enrolment would be ranked 25th amongst just over 50 African countries**²⁵. This highlights the size of the province, and the importance of province-level research. Moreover, the act of compiling and disseminating a quality provincial report can serve as a catalyst for capacity building, and can raise the status of EMIS in the organisation.

It should be remembered that the EMIS office’s key function is to collect data and produce basic reports. Its function is not to produce more in-depth data-driven research. For that, a separate research section is needed (see discussion in section 5). The basic reports which KZNDoe’s EMIS section should aspire to produce should cover matters such as learner-educator ratio trends²⁶, trends in learners by age, patterns of within-province migration seen in the enrolment data, and alignments between provincial enrolment numbers and population estimates produced by Stats SA²⁷. **LURITS data should be used to identify dropping out ‘hotspots’ in the province**, or areas where the dropping out from school of children of compulsory school-going age is prevalent. This will allow for better targeting of interventions aimed at preventing dropping out. This type of work is made a bit difficult, but by no means impossible, by the fact that unique learner identifiers in the LURITS data have to some extent changed over the years. This data problem obviously makes it difficult to distinguish between, on the one hand, an identifier that changed (or an apparent drop-out followed by an apparent ‘drop-in’) and, on the other hand, a real drop-out. The problem seems relatively non-serious in KwaZulu-Natal. In the 2015 LURITS data, 89% of KwaZulu-Natal’s grades 2 to 12 learners could also be found in 2014 data, using the unique LURITS identifier. Nationally this statistic was 80%, and KwaZulu-Natal emerges as the fourth-best province.

It seems clear that even with a ‘strong centre’ in Pietermaritzburg, **for certain EMIS projects national leadership and money is needed**. KZNDoe EMIS officials reported that it was time-consuming and sometimes impossible to extract LURITS data from the national SITA mainframe. This problem could be one of provincial networks, but a discussion of similar problems in section 4.5 suggests the problem may also be the capacity of the national servers. Clearly progress with regard to SA-SAMS depends strongly on national action. The same

²⁵ To illustrate, KwaZulu-Natal has somewhat more school learners than Senegal and Tunisia.

²⁶ Gustafsson (2016a) provides guidance on how learner-educator ratios can be calculated and interpreted, whilst taking into account complexities such as the needs of small schools, privately paid staff in public schools, and the counting of Grade R teachers.

²⁷ As discussed in the literature review, there are noteworthy discrepancies between the two which should be understood by the provincial planners, including planners outside the education department.

could be said for the natural extension to an effective and web-enabled SA-SAMS, which would be a 'business intelligence' interface designed to serve the needs of managers at various levels, and drawing from the SA-SAMS database. Whilst LURITS data make fraudulent enrolment inflation far more difficult, relative to surveys that collect aggregates, LURITS is not immune to this problem. For cost and other reasons it makes sense for the DBE to be responsible for designing and implementing measures aimed at combatting fraud with respect to provincial learner databases.

Capacity building, in the form of training and the hiring of good staff, is essential to build a strong core team of EMIS officials, and for general progress in EMIS. KZNDoe officials would like stronger national leadership in this regard. Moreover, it seems as if some of the time spent in national meetings on planning activities could be re-directed to capacity building. **Capacity building should be based on a careful analysis of need, and ongoing assessment of the effectiveness of existing capacity building strategies.**

The year 2017 is set to be a critical year in the development of EMIS, as in 2017 for the first time the EMIS surveys – the Snap Survey and Annual Survey of Schools – will be dispensed with as surveys. In their place, data collected through SA-SAMS will be aggregated to produce the standard tables of the two surveys. Possibly one of the more challenging aspects of this migration will be to ensure that the contents of the ASS teacher questionnaire are replicated through the SA-SAMS processes. This is in part because these teacher questionnaire data have been under-utilised (some would say not utilised at all) in the past, meaning the incentives to ensure these data are all entered on SA-SAMS may be low. As argued strongly in the Western Cape report, better use of the ASS teacher questionnaire data would help to fill many serious knowledge gaps in relation to teachers.

Way forward

The completion, in 2017, of a multi-year migration process from surveys that collect aggregates to a reliance on detailed individual-level data from SA-SAMS, in KwaZulu-Natal and across the other provinces, represents a turning point towards more reliable data for planning purposes. However, as the change to the new approach is completed, data quality assurance efforts will have to focus more strongly on new types of problems arising out of, for instance, the data merging processes. This is especially so as the migration to individual-level data is occurring before web-based data transfer and merging systems have been set up. The risk of fraudulent enrolment inflation by schools is reduced when data on each learner are available, but even the latter requires data quality assurance and anti-fraud procedures.

In two areas careful and strategic decision-making is needed. Firstly, whilst shortages of office-based EMIS staff to perform data merging and quality assurance may be a real problem currently, such **staff shortages may become less of a problem in the coming years** as the movement of data from SA-SAMS in schools to a central data warehouse becomes more automated, partly through web-enablement. It would be a mistake to establish permanent positions for routine tasks which may be automated within some years.

Secondly, there appears to be a need to **balance the EMIS responsibilities of the provincial head office with those of the twelve district offices**. Complex work, such as the production of enrolment trend analyses, should be the responsibility of the provincial office. District offices should have easy access to the data, and should be expected to refer to these data when they interact with schools. This would roughly be in line with the way Western Cape has organised this work. The need to capacitate districts in the area of EMIS should not detract from the need for **a strong 'provincial centre'** which is adequately resourced and can guide districts in their work, and perform more complex work which districts are not expected to do.

There is **development work which should occur at the national level** because this is cost-effective. The development of SA-SAMS is clearly seen as a national responsibility. Arguably, other tasks such as the development of ‘business intelligence interfaces’ for use by provinces and districts, the formulation of policies governing data quality assurance in the new survey-less environment, and EMIS training are all optimally managed by the DBE. Much of the EMIS challenge thus lies in developing capacity in the DBE in these areas of responsibility, and in good communication between the national and provincial levels in relation to the needs of provinces.

4.4 Finance data

A number of finance data issues are dealt with in section 4.5 below. In particular, the important issue of delayed entry of expenditure transactions onto the Basic Accounting System (BAS), something which complicates expenditure control, is discussed. Apart from this problem, **BAS seems to serve its purposes well**, according to its users. The general effectiveness of the financial systems was also noted in the Western Cape report.

However, there are finance data which fall outside BAS. Above all, data on the **revenue and expenditure of each school fund** are decentralised and do not exist in any central database. SA-SAMS, which includes a finance module, provides one option for schools to organise their financial data. However, it seems that finance data from SA-SAMS are not prioritised for transfer into provincial ‘Sequel Server’ databases²⁸.

SA-SAMS is currently not a mandatory system as far as school-level financial accounting is concerned. If it became mandatory, then **SA-SAMS would in effect embody the chart of accounts (COA) for schools**. Though work has occurred in the past on the development of a national school-level COA, no standard seems strongly promoted, in KwaZulu-Natal or any other province, meaning that schools are relatively free to adopt the accounting structure that suits them.

The rest of this section focusses on school-level data indicating **what rights schools have when it comes to receiving cash for non-personnel items**, and making purchases themselves. The alternative is for the department to withhold funds and spend money on behalf of schools. These data on school-level rights have seldom been analysed, though the rights in questions have far-reaching implications for how finances and procurements are managed.

Three functions are relevant, and relate to **sub-sections (a), (c) and (d) of section 21 of the South African Schools Act (SASA)**. The text from the Act runs as follows:

- (a) To maintain and improve the school's property, and buildings and grounds occupied by the school, including school hostels, if applicable;
- (c) to purchase textbooks, educational materials or equipment for the school;
- (d) to pay for services to the school;

Virtually all schools in KwaZulu-Natal have functions (a) and (d). As shown in Table 4 below, almost exactly half of schools had the crucial function (c), which deals with books and educational materials, in 2016. Table 4 uses a school-level dataset provided by KZNDoE to the national department. The situation is not that different between primary and secondary schools. However, there are **large differences across districts**, even if one considers only quintiles 1 to 3 schools, schools which are more likely to experience spending restrictions.

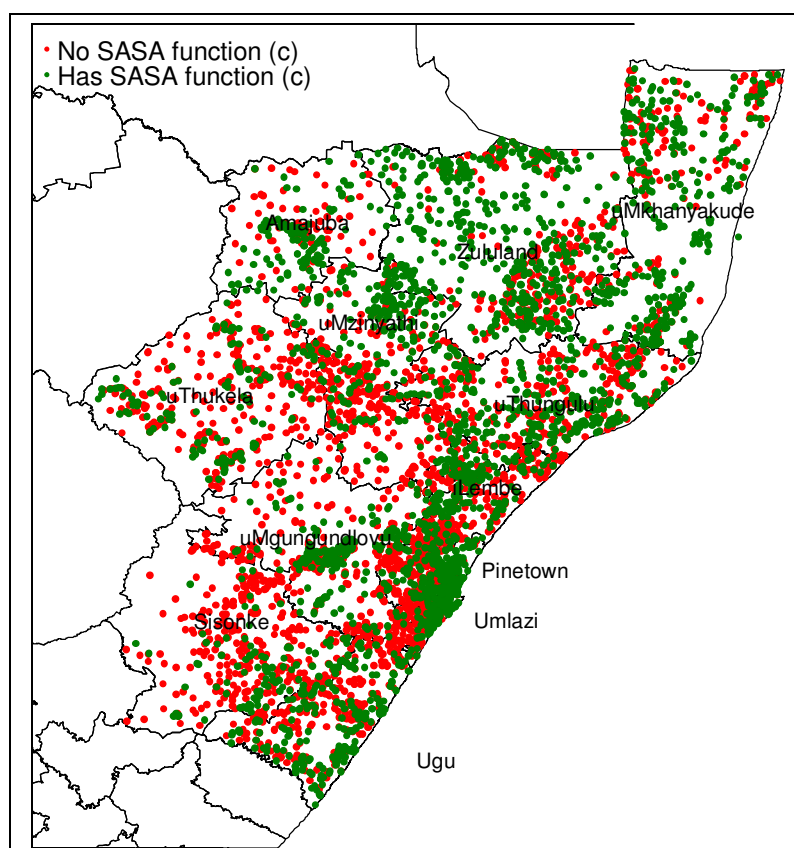
²⁸ The literature review describes these databases.

Table 4: Percentage of schools with section (c) functions

District	Primary	Secondary	All	All quintiles 1 to 3
Amajuba	65	54	60	57
Pinetown	55	59	56	39
Sisonke	14	41	27	25
Ugu	44	47	45	41
Umlazi	43	45	44	12
Zululand	67	76	70	69
iLembe	43	49	45	45
uMgungundlovu	49	46	48	37
uMkhanyakude	68	57	65	65
uMzinyathi	37	49	42	40
uThukela	31	25	29	26
uThungulu	47	53	49	47
Province	48	51	49	46

Figure 3 below seems to indicate that **districts in the north of the province are more likely to have schools with function (c)**.

Figure 3: Schools receiving money for textbooks



The best way of understanding whether it is district practices or, say, school quintile which is driving the probability that a school will have function (c), is to analyse all relevant variables simultaneously in a regression. This is what was done in producing Table 5. The values in the last column are the most relevant for the discussion. As one might expect, being in quintile 5 increases one's probability of having function (c) by 43 percentage points (relative to being in quintile 1, the omitted quintile). This is when one controls for the presence of other variables such as district and level of the school. Being a secondary school in fact *decreases* one's

probability of having function (c) very slightly (by 3 percentage points). Relative to Sisonke (the excluded district), all districts except for Pinetown and uThukela display statistically significant differences in their probabilities. **Zululand stands out. This district, even when one controls for other variables, is associated with a 40 point higher probability.** Smaller schools display a somewhat lower probability of having function (c). Having 100 fewer learners diminishes one's probability, on average, by 3 percentage points.

Table 5: Logit model on probability of having function (c)

<i>Variables</i>	<i>Coefficient</i>	<i>Change in value</i>	<i>Change in probability</i>
Is quintile 2	0.15*	0 to 1	0.04
Is quintile 3	0.10		
Is quintile 4	0.70***	0 to 1	0.17
Is quintile 5	2.30***	0 to 1	0.43
Has secondary grades	-0.13**	0 to 1	-0.03
Is Amajuba	1.08***	0 to 1	0.25
Is Pinetown	0.26		
Is Ugu	0.67***	0 to 1	0.16
Is Umlazi	-0.72***	0 to 1	-0.17
Is Zululand	1.91***	0 to 1	0.40
Is iLembe	0.78***	0 to 1	0.19
Is uMgungundlovu	0.54***	0 to 1	0.13
Is uMkhanyakude	1.70***	0 to 1	0.36
Is uMzinyathi	0.73***	0 to 1	0.18
Is uThukela	-0.12		
Is uThungulu	0.79***	0 to 1	0.19
Learners / 100	0.13***	+1	0.03
Constant	-1.52***		
N	5450		
Pseudo R ²	0.118		

*Note: The dependent variable is having SASA section 21 function (c). *** indicates that the estimate is significant at the 1% level of significance, ** at the 5% level and * at the 10% level. The change in probability is obtained using the mfx compute command in Stata. This change was only calculated for variables whose coefficient was significant at (as a minimum) the 10% level.*

In part, Table 5 is meant to demonstrate the kind of data analysis which ought to be employed more frequently, in KZNDoE and across the schooling system in general. But what do these results suggest, in terms of policy? They clearly indicate that as a school whether one receives cash for books depends on which district one is in. This is probably not optimal, and is not in line with SASA, which implicitly advocates uniform criteria for determining which schools have which functions (within each province, if not nationally). According to SASA, the department should give schools procurement powers in line with the management capacity of the school principal. In other words, the results suggest **the existing distribution of SASA section 21 functions should perhaps be revisited.** (An alternative and fascinating interpretation would be that schools in Zululand *are* better managed and should therefore have more SASA functions. That would obviously raise the question of how this district had achieved this.)

The policy debate should be informed by the fact that schools commonly complain about not having function (c) granted to them. These **complaints may or may not be justified.** Firstly, it is argued that procuring through the department limits the goods that the school can procure. Secondly, this arrangement can result in longer delays when goods are delivered to schools. Thirdly, some schools complain that information on how much the department has spent out of the school's account is not easily accessible.

Way forward

One area where change is possible and perhaps necessary in the coming years is the area of school finances. As pointed out in the literature review, it seems like that the Auditor-General (AG) will pay more attention to school-level finances in future. The AG may raise equity questions around the differences across schools in terms of their access to state funds (this is what the current section has largely focussed on). **Measures of school effectiveness are important for the management of schools.** These measures should ideally draw from a variety of data sources, including data on learner performance, levels of poverty around schools, and the performance ratings of school staff, in particular the school principal. The measures should be used in, for instance, determining the financial management rights of schools.

4.5 Human resources and payroll data

A 2013 **Deloitte report on the ‘post provisioning’ processes** in KwaZulu-Natal²⁹, whereby decisions are taken on how many educators should work where in the province, points to a number of problems in the planning and implementation stages. Many of these problems are common across seven of the nine provinces, according to Deloitte’s reports. Only Western Cape and Gauteng are seen to run a relatively successful post provisioning process. In KwaZulu-Natal, six problems stand out according to Deloitte. The current section uses these six problems as a point of departure to examine the issues in more detail.

- **A lack of commitment to remain within budget.** In the years up to 2013 essentially more posts were promised and filled than what was affordable. This would have been due to a mix of two factors. Firstly, political and union pressure to raise staffing levels and not to move ‘excess educators’ working in schools where enrolment had declined, has been strong. Ultimately, this type of pressure is about pressurising the provincial treasury to find funds to cover an over-expenditure, though it can also be about creating pressure to divert funds from non-personnel items to personnel within the education system. Secondly, there have been weaknesses in the technical areas of financial and data analysis, combined with challenges in the abilities of analysts to convey findings to stakeholders. Some in KZNDoE would argue that the problem is entirely political and that there is little technocrats can do to counteract pressure to exceed budgets. Whilst understandable, this argument seems incomplete. In an environment where analysis is weak, it becomes easier for political risks to be taken. Even in the analyses of capable analysts, projections of future costs in an area as complex as the staffing of KwaZulu-Natal’s schooling sector would carry some margin of error. However, if it is widely understood that these margins of error are large, it becomes easier for politicians to argue that spending risks can be taken. These matters receive more attention below. What is noteworthy is that strong pressure to cut costs in recent years have changed the dynamics somewhat since 2013, and have created new problems.
- **Debilitating silo effects within KZNDoE.** Successful post provisioning should involve close collaboration between three sections within an education department: EMIS (in particular as far as enrolment figures are concerned), finance, and human resources planning. In KwaZulu-Natal this collaboration has been weak, partly because pressure to collaborate from the departmental leadership has been lacking, and because people have not set up and properly maintained the necessary cross-cutting task teams needed to break through the silos. Western Cape has been considerably more successful in this regard. With regard to data, what has been lacking is the sharing of data, analysis skills and reports across the three sections.

²⁹ Deloitte, 2013.

- **Understaffing and poor technical capacity.** A few key posts in the KZNDoE head office are not filled, and technical skills are often weak. This still applied in 2016 when the discussions with officials for the current project were held. Weak technical capacity is something virtually all senior managers in the department are prepared to acknowledge is a serious problem. The literature review produced for the current project included an assessment of two KZNDoE annual reports. It is clear from this assessment that technical capacity shortfalls are often at a rather basic level and relate to basic accounting, report-writing and the building of specific arguments. (To some extent the same emerged from the assessment of Western Cape’s annual reports, though here the problems were less serious.)
- **Poor record-keeping and archiving practices.** As pointed out in the literature review, even at the national level, within the DBE, there is a ‘knowledge management’ problem insofar as reports, produced by officials and by consultants for the DBE, are too easily lost after a few years, or at least not accessible to all the people who should have access to them. The Deloitte report on KwaZulu-Natal points out that post provisioning decisions, which often have large budgetary impacts, tend not to be properly documented. Moreover, key datasets, such as the number of posts allocated to schools, and adjustments made to that, within a particular year, are not safely archived for future reference in locations easily accessed by all officials concerned.
- **Insufficiently reliable enrolment (by subject) numbers.** Enrolment figures, in particular enrolments by subject in grades 10 to 12, are not always properly verified, creating opportunities for fraud whereby numbers are inflated to increase a school’s entitlements to posts.
- **Difficulties in relocating ‘excess educators’.** Employees declared in excess in schools whose enrolments have declined are too often not moved to empty posts elsewhere, posts which are then filled with temporary employees, resulting in a ‘double parking’ problem. This is a problem experienced to varying degrees by all provinces.

The Deloitte report is very technical in the sense that it does not examine in any depth the **political factors** which hamper the implementation of post provisioning. ‘Political factors’ in the current report means factors other than policies and data. In the context of the schooling system, the interests of the teacher unions would represent a strong political factor. It is extremely difficult to obtain a good sense of the size and shape of the political factors in the KwaZulu-Natal schooling system. What would have helped is opinion data of the kind collected by Western Cape’s ‘customer satisfaction survey’ (where the customer is essentially the school)³⁰. According to a 2016 report³¹ produced by a Ministerial task team on corruption surrounding educator posts, KwaZulu-Natal and North West emerge as the worst provinces when it comes to the degree to which rational and policy-driven planning (which one can also think of as data-driven planning) are under threat. KwaZulu-Natal is the only province where corruption around appointments appears to have led to murder. Yet it is important not to exaggerate or sensationalise the threats. Until there are better data on perceptions, it is difficult to be conclusive about how widespread corrupt practices are.

The rest of this section elaborates on the six points made above, drawing to a large extent from the conversations held with KZNDoE officials in 2016.

³⁰ Western Cape’s survey does in fact not include questions relating directly to political or union influences, but the survey is well-suited for gathering information on these matters and the relevant questions could easily be included.

³¹ Department of Basic Education, 2016d: 46.

As pointed out in the literature review accompanying the current report, the **leadership** within a government department is highly influential when it comes to shaping the **organisational culture** and bringing about an **enabling environment** which allows for the effective use of data. This should not be controversial. In fact, the Auditor-General has attributed many of the failures seen in financial and non-financial accounting in the education departments to leadership weaknesses.

There is a sense amongst KZNDoE middle managers that leadership in the organisation could be better. How does this impact on the collection and use data? The current situation means that there is an insufficient focus on fixing critical and relatively inexpensive elements of the organisation which could improve the data situation. Several managers complain that computer servers do not have the required capacity, resulting in problems in transferring and backing up data, and raising the risk that data will be lost. Networks are slow and unreliable. Managers often avoid using their official e-mail addresses for work purposes because, it is claimed, e-mails disappear and are thus an unreliable tool for sharing information. In general, a focus on quality information is lacking in the organisation, meaning the discipline required to systematically clean and quality assure data is often absent. The idea that information should serve the interests of the organisation as a whole is often lacking. It is often seen as preferable to limit the sharing of information amongst colleagues as sharing might expose individuals to scrutiny or criticism around their products, be it data or reports. Given the sensitivity of the issues, it was obviously difficult to delve deeper with the officials. Yet it needs to be emphasised that the interviews pointed to **an organisational culture which was starkly different and less enabling compared to what was seen in the Western Cape Education Department**.

The top leadership of KZNDoE were not interviewed so impressions gained from officials are bound to be somewhat one-sided. What is clear is that organisational culture is built not just by individual leaders but by all managers in an organisation. What seemed lacking amongst many interviewees was a sense that they themselves can to some extent bring about positive change in the organisation by, for instance, creating **pockets of excellence** in the area of data use and reporting.

Technical capacity gaps are undoubtedly a problem in KZNDoE. Yet there are clearly some very skilled people working in the department head office who are easily comparable to their peers in a province such as Western Cape. However, the environment in the organisation seems not to have been conducive to collaboration between officials on specific tasks. Moreover, building capacity amongst the next generation of managers, in part through the **transfer of skills within the organisation**, is not embedded within the organisation as it should be (this same criticism can be made of the department in Western Cape).

What is noteworthy is that a number of officials interviewed said the situation was **better a few years back**. This suggests that it is possible to rectify the situation in the coming years, partly so that an environment that is conducive to effective use of information is created.

KZNDoE relies to a greater degree than its Western Cape counterpart on the **State Information Technology Agency (SITA)** for its computing capacity. This is seen as a serious problem by various KZNDoE officials as SITA's services are considered weak. As pointed out in the Western Cape report, SITA itself has in the past acknowledged that it has in many respects not provided the services it should. The relationship between KZNDoE and SITA is a critical factor that needs to be addressed if KZNDoE is to work more effectively with data. There are no easy or clear solutions. Setting up an alternative service provider, as has been done in the Western Cape in the form of the Centre for e-Innovation (CEI), would take many years and could be politically difficult. An alternative, suggested by people who are familiar with the relationships with SITA of different government departments, is to establish capacity within KZNDoE to **contract more smartly** with SITA. In particular, the various stages of

information systems projects should be better monitored by KZNDoE, and one should not proceed to a new stage before previous stages have been properly quality assured.

Moving to more technical matters, the post provisioning cycle in the department begins with a fairly simple calculation of a global unit cost, or **average cost per employee**, which forms the basis for the determination of the number of affordable posts for the coming year. As discussed above, this number of affordable posts may in the end not be respected and may be inflated as a result of political pressures. However, that is not the concern here. The concern here is that the calculations of the global unit cost seems too simple, and does not take into account a number of important factors. Officials in KZNDoE seemed to agree that the current approach (an approach which is apparently followed in many other provinces too) is inadequate. However, capacity to undertake more sophisticated modelling, and guidance from the national level in this regard, are lacking. What are the problems with the current global unit cost as it is currently calculated? There are two key problems.

The easiest problem to tackle is that the current approach assumes everyone takes up all benefits, which come to 37% of the basic salary. However, many **employees do not make use of all benefits**. Calculating the extent of take-up in a recent month is a relatively easy task. Appendix C indicates that in KwaZulu-Natal, benefits over basic pay came to 32% in 2015, which is almost equal to the national figure (an earlier report indicated that the national value was also 32% in 2012³²). Importantly, the kind of analysis undertaken for Appendix C is difficult to do without the original microdata, containing individual payments by item code, per employee. In fact, for many important analyses, these microdata are needed. What analysts in most education departments do is to request aggregated data, for instance the total spent on the medical subsidy in a particular month. In KZNDoE records of individual employees on Persal per month are extracted. This is good for some analysis, but financial analysis is limited as the only monetary value in the employee records is the notch value, or the value of the basic pay which should be received. Not having periodic payroll downloads with actual payments per employee clearly limits what can be done. For instance, obtaining patterns of uptake or variations in the benefit amounts paid per employee are not possible. For a migration to a more sophisticated level of analysis to occur, KZNDoE will need to build capacity in the use of Microsoft Access or, preferably, a statistical analysis package. As discussed in section 4.1 above, whilst Excel is highly suitable for certain uses, it is not an appropriate tool for analysing large sets of microdata, such as monthly records of payments made. However, what must also occur in KZNDoE is that adequate hardware in terms of computers and servers must be acquired so that large datasets can be stored³³.

The second problem is that unit cost changes are sensitive to the age distributions of employees and rates of entry and exit from the system. Currently, a bulge of employees is reaching retirement age. The replacement of exceptionally large numbers of older and better paid employees by younger and less costly employees has the effect of reducing the average unit cost (or reducing the year-on-year increase) in ways that are often not fully appreciated. It is estimated that not taking into account leavers and joiners, and the ages of these people, can lead to a unit cost which is 0.3% higher than it should be. This gap is likely to become larger in future years. Some projections have indicated that **by 2033 the average cost of an educator will be 15% lower** than it is currently in real terms³⁴. This obviously has far-reaching implications. Taking these factors into account when estimating unit costs for the

³² Gustafsson, 2012: 33.

³³ However, even with large volumes of data storage it is necessary to be careful about how data are stored. Downloads from SITA tend to contain large volumes of repeated values, such as the names of individual districts. It should be standard practice to code such values, or data storage can easily be depleted, even with large volumes of storage space. Moreover, un-coded data taking up more memory than is necessary move slowly across networks.

³⁴ Department of Basic Education, 2015: 27, 68.

following year (and the years that follow) is complex, and involves modelling retirements and new joiners. Some work has been done by the DBE. How to proceed in this area should be workshopped by the ten education departments.

KZNDoE officials working on post provisioning have expressed satisfaction with the **Microsoft Access tool developed by the DBE** to convert enrolment statistics to post entitlements (or post establishments) per school. This is surprising if one considers that officials from other provinces have criticised the tool, for instance for its inability to provide sufficient management reports which can alert users to data errors.

Some analysis³⁵ has pointed to **the lag between learner and educator movements** being greatest in the case of three provinces: KwaZulu-Natal, Eastern Cape and Limpopo. In these provinces for many years leading up to 2013 the distribution of educators tended to follow most closely the distribution of learners seen two years previously. In other provinces, this lag was shorter. There are many possible reasons for these lags. It is possible that old enrolment data are being used when post entitlements are calculated, or that there are delays in moving educators in line with newly issued post establishments.

Moving teachers when enrolments shift, or **relocating ‘excess educators’**, is a logistically and politically complex matter. Educators often resist moving for personal reasons, and will often seek support from their union. Regulations governing the powers that the education department has to move educators can be open to differing interpretations, for instance with regard to when an educator is suitably qualified for a posting in another school. In KwaZulu-Natal open vacancy lists are used to relocate educators above level 1, meaning heads of department and deputy principals. These lists thus help to ensure that employees are matched with a placement which they are relatively satisfied with. For level 1 teachers, a different approach is followed. The transferring of a teacher generally occurs within a district, and district planners are responsible for deciding which teachers move where. Perhaps surprisingly, given the strength of teacher unions, this approach is not regarded as problematic by most stakeholders, it seems. As pointed out in the Western Cape report, in that province even level 1 teachers are relocated through the use of published vacancy lists.

A problem experienced by all provincial education planners is that spending on personnel (and other items) can be loaded onto the financial systems retroactively, given that a **modified cash basis for accounting** is used (this was explained in the Western Cape report). It is thus not possible to know what the total spending within a financial year has been until a few months after the financial year has ended. Thus month-by-month decisions around whether, for instance, filling of empty posts will result in over-expenditure in the financial year must rely in part on modelling and projections in relation to historical spending which has not been loaded onto the system yet. Officials KwaZulu-Natal cite this as a serious complexity which makes planning difficult, and raises the risk of both over-expenditure and under-expenditure. In KwaZulu-Natal the situation seems to be relatively serious as a result of the recent devolution of data capturing onto the Persal system from four regions to twelve districts. The twelve districts have limited capacity for this work, meaning events such as the hiring of temporary employees might be recorded several weeks or even months after the fact. On the positive side, what officials at the KZNDoE are *not* concerned about is that the devolution of control has increased corrupt practices such as the undue promotion of employees to higher salary notches. Past analysis has suggested that this has been a real risk in a few provinces (including KwaZulu-Natal) around eight years ago³⁶.

In the current context where there is arguably **unprecedented pressure to cut costs**, difficulties in estimating month-by-month expenditure on personnel seems to have especially

³⁵ Gustafsson, 2016a: 55, 62.

³⁶ Department of Education, 2009.

serious consequences. The Western Cape report provided a measure of this difficulty for all provinces in recent years. KwaZulu-Natal seems to have been better than other provinces in dealing with the problem, at least judging by the extent to which a financial year's personnel spending figure fluctuates after the end of the year across different estimates. However, the situation has recently worsened in KwaZulu-Natal, it seems. The *Estimates of Provincial Revenue and Expenditure* (EPRE) of KwaZulu-Natal released shortly after March 2016 (the end of the 2015/16 financial year) refers to a personnel spending figure for education of R35.1bn. By the time the final annual report was released a few months later this value had dropped to R34.5bn. This is a gap of 1.6% or R552m. It seems as if a worsening ability to estimate personnel spending has permitted under-expenditure arising from excessive cost-cutting. Put differently, if estimates do not provide an accurate picture of how much has been spent to date, and the pressure to cut costs is very strong, it is possible for planners to 'play it safe' and for cost-cutting to be over-implemented. (On the positive side, KZNDoE was one of the few provincial education departments to have published its annual report for 2015/16 on its website by November 2016.)

What was worrying is that interviewees in KZNDoE did not appear to have a sufficiently clear idea of where cost-cutting was being aimed at. This is to be expected if ongoing monitoring is not detailed enough, and if it is not at least partially refocussed to deal with the new context of cost-cutting. To some extent there seemed to be some confusion between decisions and policies, on the one hand, and actual implementation, on the other. Decisions that particular cost-cutting steps should be taken may be implemented by implementers in unexpected ways. Specifically, there was a sense amongst officials that cuts were concentrated on *non*-educator staff. An analysis produced by the DBE indicates that over the 2012 to 2015 period KwaZulu-Natal has indeed been one of only two provinces where the number of permanent educators has increased (the other province is Western Cape). However, KwaZulu-Natal, like all provinces, has seen a worrying **freezing of appointments into schools-based education management posts** over the 2012 to 2015 period³⁷. Specifically, the number of people in these posts has declined by 7% over the three years in the province. Moreover, despite the increase in the number of permanent educators, **the learner-educator (LE) ratio has been rising** in secondary schools since 2009 and since 2013 in primary schools. The primary school LE ratio rose by more than one whole learner, from 28.0 to 29.2, in just two years. These are trends with potentially very large effects on the effectiveness of schools. The fact that they are not flagged as major concerns by KZNDoE officials is indicative of the need to use data better to monitor trends.

What are the solutions to the financial monitoring challenges? Treasury's 'modified cash basis' is presumably not about to change. This means that provincial education departments need to **become smarter at using the available data to estimate, partly through the modelling of delayed payments, monthly spending trends**, both at the global level and with respect to strategically important areas, such as the employment of managers in schools. The DBE has an important role to play, given that the entire public service salary regime is determined nationally and not provincially. The DBE needs to provide tools to assist provincial analysts, partly on the basis of current best practices across provinces. Importantly, tools should include user manuals.

One important initiative being taken forward by the DBE is the development of a '**business intelligence**' (BI) **interface for Persal payroll data**. Essentially this facility is designed to produce aggregate reports drawing from Persal data. These reports are far more flexible and tap into a greater variety of data variables than Vulindlela, which focusses on financial data within the Basic Accounting System (BAS). DBE's BI is being developed by SITA and is web-enabled, meaning that at least in theory it could be rolled out to provinces fairly easily. Access to the Persal BI was obtained and the system was tested. Whilst it has huge potential,

³⁷ Department of Basic Education, 2016e: 5, 9, 12.

there are a few hurdles which must be overcome, and which are probably worth noting even with respect to other systems development initiatives. The most serious hurdle emerged after discussions with relevant people on why the system was often slow, or requests timed out, even when the query results that had to be transferred over the network were extremely small. The problem is that the servers SITA uses for the Persal BI are not able to process large and complex queries because the servers have limited capacity. In some ways this hurdle renders the whole system unusable, in part because a user can never be sure whether a query is simple enough to be successful. Some users in the DBE have stopped using the Persal BI because of the problem of queries timing out. Although this system is a national system, it is discussed here because resolving its problems should be a relatively straightforward matter (new servers need to be acquired) and because a system such as this one could greatly improve access to the payroll data amongst provincial planners. It has been argued above that KZNDoE needs analysts who are able to use the raw payroll microdata. These specialists are needed and the department should have two to three such people. However, beyond this set of specialists, a wider range of analysts in the department need to work with the payroll data on a less specialised basis, and for this the DBE's Persal BI would be ideal.

KZNDoE officials admit that within Persal, **component and paypoint numbers**, which indicate in which school a person is employed, could be updated more systematically. If these numbers are wrong, or not updated speedily, some analyses become difficult, and at the school practical problems can occur, like a teacher's payslip being delivered to the incorrect school. The latter was not a problem according to people interviewed in the two schools visited for this project. Of course it could be a problem in other schools.

Persal 2015 data were compared to Snap Survey data for 2015 to gain an idea of the extent to which component numbers could be incorrect in the Persal data. The data suggest that this is indeed an area where KwaZulu-Natal experiences a relatively serious problem. The measures in the following table are percentages reflecting absolute deviations at the school level between the educator counts in Persal and Snap. To illustrate, one can imagine a school which in the Persal data has 0.026% of all of KwaZulu-Natal's educators. Let us assume that the same school has 0.020% of all the province's educators according to the Snap Survey data. The absolute difference is 0.006%. This is then divided by the average between 0.026% and 0.020%, meaning 0.023%, giving us 26%. The difference between Persal and Snap with respect to the school's share of educators is 26%. This is likely to be a result of educators in Persal not carrying the correct component number identifying the school, though there are also other possible explanations (such as the fact that educators may have moved between the Snap date at the start of the year and November, when the Persal data used here were extracted). The measures in Table 6 are the averages across schools within the province. Thus on average there was **a difference of 16% in the case of KwaZulu-Natal between a school's share of all educators in Persal versus Snap**. This deviation is larger than that in the other six provinces analysed³⁸.

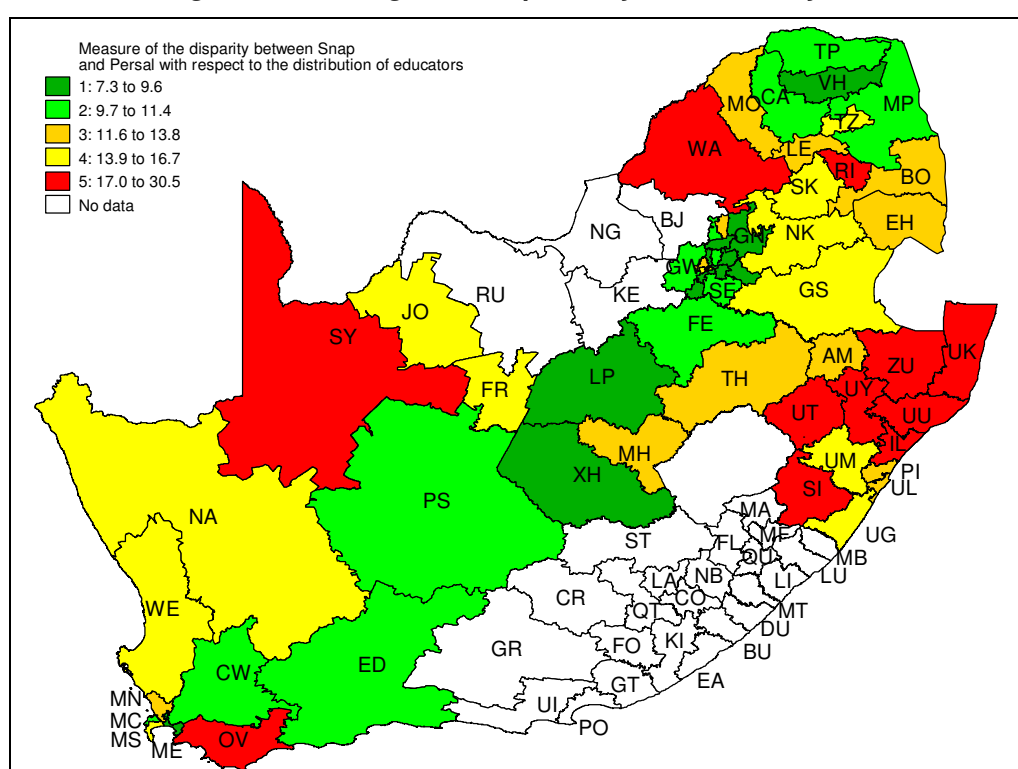
³⁸ Deviations in terms of a school's share of educators are expressed, as opposed to absolute numbers of educators as definitions of who was a permanent educator in Snap and Persal seemed to differ. Only permanent educators were considered in the analysis as these educators can be considered more stable in terms of their school location. Moreover, all schools with Grade R or Grade 1 were excluded, meaning schools analysed were largely secondary schools. This was done mostly to circumvent inconsistencies in the classification of Grade R teachers in Persal. Eastern Cape and North West are excluded from the analysis as there appeared to be exceptional problems with the Snap totals which could not be easily resolved.

Table 6: Measure of Persal-Snap school identifier inconsistency

FS	9
GP	9
KN	16
LP	11
MP	13
NC	13
WG	11

The following map repeats the analysis at the district level. It is clear that in general it is in the **more rural districts of KwaZulu-Natal** that more serious inconsistencies between the Snap and Persal school locations of educators are found. Again, it is likely that this is because component numbers (which reflect an educator's school) are not updated as they should be.

Figure 4: Persal against Snap Survey inconsistency 2015



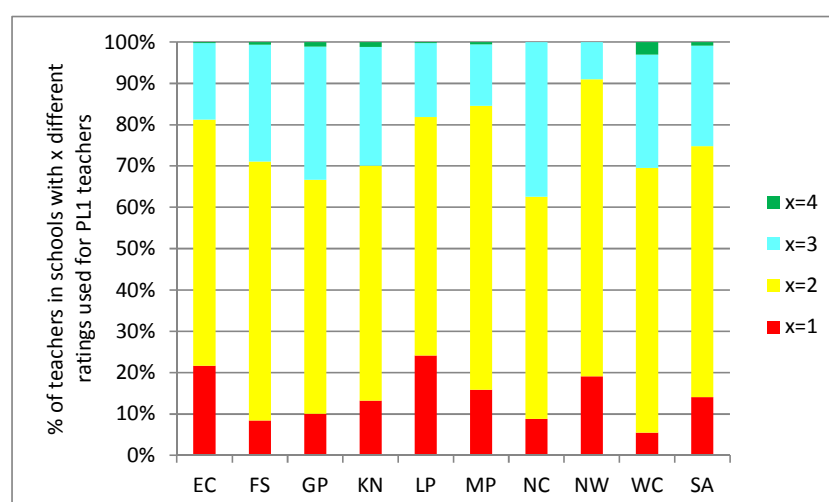
It should be noted that in order to monitor **patterns of leaving and joining** in the workforce, and to monitor **movements across schools and educator ranks** (for instance, from level 1 teacher to head of department) and, by extension, to monitor whether posts are left vacant for extended periods in a school, it is necessary to **link payroll downloads across months and years using the employee's unique identifier**, or Persal number. This type of data work appears not to happen in KZNDoe. To repeat what has been said above, in part the problem is not having the computer hardware and software and human skills to perform what is ultimately fairly straightforward analysis using large sets of data.

As has already been suggested above, the **monitoring of learner-educator ratios should be improved** in KwaZulu-Natal. Moreover, as has already been pointed out in the literature review **staff attrition** from the system is often poorly monitored (some published statistics look too high to be correct).

Teacher attendance in schools is said to be monitored better than in past years. SA-SAMS is used extensively for this at the school level, which creates the possibility of accurate province-level statistics on this in the near future, assuming that the proposed upload systems for SA-SAMS are developed as planned.

Lastly, officials in KZNDoE report that teachers in schools are reluctant to acknowledge their professional development needs, and that this is linked to suspicions on the part of teacher unions around the introduction of performance measurement systems. Teachers, it is reported, attach little importance to their **IQMS³⁹ ratings**, for instance. This is a common perception across many provinces, but one that is at odds with the data. As shown in the following graph (and in a map in the Western Cape report), almost 90% of level 1 teachers are in schools where different teachers are assigned different IQMS ratings. In KwaZulu-Natal, 30% of teachers are in schools where three or even four different ratings appear. If the IQMS were just a meaningless compliance exercise, one would expect teachers to all give themselves the same rating in a school, partly to avoid a situation where a better rating could be used as a basis for promotion into a management post. The within-school variation which clearly exists (or at least existed in 2012, the last year in which IQMS data were gathered systematically across the country) suggests that in most schools the IQMS is not merely a compliance exercise and does result in differentiation across teachers. The bottom line is that provincial planners should pay more attention to patterns in the IQMS data as these seem to tell us important things about dynamics within schools.

Figure 5: Mix of IQMS ratings in schools in 2012



Source: Microdata collected for Department of Basic Education (2012).

Way forward

As in the Western Cape, in KwaZulu-Natal there is a need for a deeper understanding amongst key managers and analysts of a number of **human resources planning indicators**. This deeper understanding will lead to better and more focussed uses of data in the management of human resources. What indicators are poorly calculated or not well understood in KwaZulu-Natal? Key indicators which stand out are: the **unit costs** of various categories of employees (including how a changing age structure is influencing this unit cost); **learner-educator ratios** (including inequalities across schools and trends over time); **staff attrition rates**; and **patterns in the performance management (IQMS) data** and their significance for understanding school effectiveness. As was pointed out in the Western Cape

³⁹ Integrated Quality Management System.

report, the human resources chapter required in the departmental annual report represents a useful channel for organising the new work.

The preceding discussion has highlighted serious **organisational culture shortcomings** which were on the whole not found in Western Cape. The negative consequences of these shortcomings are magnified in the area of human resources, given the cost and strategic importance of these resources, and the fact that human resources planning implies work with variety of datasets and collaboration across three key sections: financial planning, human resources planning, and EMIS.

From a data perspective, the problem is that the culture of the organisation does not sufficiently recognise **the centrality of data and information systems for a well-functioning education department**. In Western Cape, this recognition was much stronger. One manifestation of this is that often the basic needs of people in the organisation working with data are not catered for. Computer servers do not have the capacity to house data securely, computers often have less processing power than they should, networks are slow, and e-mail is not trusted as a means of sharing information. This environment would frustrate committed people and allows less committed people, or people who have given up, to easily find excuses for not producing analyses and reports. Apart from problems relating to data systems, what is insufficiently prioritised within the organisational culture is proper documenting of all key decisions, proper archiving of documents, and sharing of critical information across sections.

How should KZNDoe tackle these problems? It would probably be a mistake to try and fix everything at once. The best seems to be to prioritise the fixing of key processes, and for the organisation's leadership to focus strongly on this. This should not stop other key processes from fixing themselves in the meantime, but there is only so much that can be put on the official agenda at once. One can think of the solution as one of creating **'pockets of excellence' within the organisation**, which can then have positive knock-on effects on other areas. **Getting unit costs right** seems one area which should be formally prioritised immediately. As discussed above, the task would involve ongoing downloading of actual payment records, the establishment of a set of routine analyses of these data, and the production of monthly, quarterly and annual reports. This implies moving beyond the current practice of extracting just aggregates through existing Persal and Vulindlela management reports, and examining only employee records, without analysing patterns within individual payments, including benefit payments, to employees. It also implies relying not just on Excel, but also on Microsoft Access or (preferably) some statistical analysis package.

What the deeper data analysis described in the previous paragraph would also permit is **better monthly monitoring of budget compliance**. This has become especially important in the current environment of cost-cutting, where difficult decisions must be taken around, for instance, whether to freeze empty posts. It is a mistake to believe that cost-cutting *decisions* predict perfectly actual cost-cutting *actions* on the ground. The latter may display unexpected patterns which are only picked up through analysis of the payroll data focussing on, for instance, how long vacant posts remain vacant. What is crucial is for KZNDoe to clean up **school identifiers on Persal**. Staff move across schools and if this information is not updated accordingly in the payroll data, it becomes difficult to see whether the burden of cost-cutting is being shared equitably across schools. Whilst school identifiers are relatively up-to-date in KwaZulu-Natal, the analysis presented above suggests the situation is a bit worse in the province than in the rest of the country.

Change within government bureaucracies is notoriously difficult, not just in South Africa. What might ensure that the changes recommended above are carried through? Clearly, those working with data need the necessary hardware and software. This should be fairly easy to arrange. But these people should also be required to work to a greater extent with more junior

staff, who would perform more routine tasks at the same time as they build their own capacity. Junior staff must be thought of as the next generation of planners. In the software industry, the term ‘heroic programmer’ is used to refer to programmers who do strategically vital work for the organisation, but work largely on their own, without documenting their work and without a clear obligation to institutionalise the skills they have. KZNDoE, like other government departments in the country, need to move beyond the ‘heroic programmer’ syndrome and **ensure that good practices and skills are spread across the institution.**

Top management in KZNDoE should insist that analysts working on, for instance, unit costs **explain their work at top management meetings**, including the limitations and risks within the analysis (such limitations are nearly always a reality). This can help top managers to gain a better idea of the dynamics of the system, but also forces technical staff to be clear and improve their presentation skills. Technical staff may also become aware of shortcomings in their work that they would otherwise not have seen. Clearly some of this interaction between top managers and more technical staff exists in KZNDoE, but there appears to be too little of it.

Progress in KZNDoE would moreover require a **sustained focus** on key areas of change, such as the monthly monitoring of human resources. This cannot be over-emphasised. As a guide to innovation by the International Institute for Educational Planning (IIEP) once pointed out, innovation is not just about change. It is about changing critical things at critical points in time, but then ‘staying the course’, or persisting in getting particular systems or processes right, something which can take years⁴⁰. The Western Cape department has been particularly good at this.

Western Cape draws to a fairly large degree on **experts in universities and consulting companies** in the province to accomplish its technical work. Because it has done this for many years, it has contributed to the creation of a pool of analysts outside government with a better understanding of the public sector. Clearly the learning should be seen as bi-directional. KZNDoE is fortunate in that its province includes a number of universities with skilled analysts. Attempts have been made in the past to build partnerships. A 2010 policy review of the education sector, spearheaded by KwaZulu-Natal Treasury and drawing from the inputs of individuals from a range of organisations offers an example of what can be done⁴¹. This type of work should continue.

Finally, KZNDoE, like the Western Cape department, should insist **the DBE plays a leadership role in the area of human resources planning**, given that policies and systems in this area are largely national. Moreover, KwaZulu-Natal Treasury could become more actively involved in assisting KZNDoE in establishing tools and methods for monitoring personnel expenditure.

4.6 Physical infrastructure data

The prioritisation of physical infrastructure interventions occurs at the district level. Data generated by this process include ten-year project lists with school-level details. These lists are updated each year. At the province level the district lists are checked and their suitability assessed against **enrolment data and data in the national school-level database of infrastructure conditions, NEIMS**⁴². NEIMS is updated by KZNDoE officials through a web facility, as projects are completed, and from time to time these officials extract raw NEIMS data for their own analysis. Infrastructure development plans have also been shaped

⁴⁰ Inbar, 1996: 42.

⁴¹ KwaZulu-Natal: Provincial Treasury, 2010.

⁴² National Education Infrastructure Information Management System.

by projections of expected enrolment shifts in the coming years within the province. This work has been done by the University of KwaZulu-Natal.

Interviews with officials and a look at a few Excel-based planning tools used within KZNDoE suggest that data use in the area of infrastructure is relatively good. The geo-locations of schools are extensively used in the analysis. As in Western Cape, there is a sense amongst officials that **Treasury interventions** aimed at strengthening infrastructure planning work have created **a better enabling environment for the work**. There is also a sense that future improvements can be expected.

KZNDoE officials confirm, as do their Western Cape counterparts, that infrastructure is an area which is particularly susceptible to undue political interference, in the form of plans and priority lists being overridden by lobbyists for specific local areas who succeed in getting their area prioritised. Strengthening the formal planning process further is seen as necessary, for instance through more publicly transparent priority lists. If the expectations of schools can be more firmly linked to these lists, it becomes **more difficult for individual schools to ‘jump the queue’** through political connections.

In order to improve responsiveness to new and urgent repair interventions, KZNDoE is exploring the establishment of an **infrastructure call centre** along the lines of such a facility existing in the Gauteng Department of Education.

Way forward

As in Western Cape, there appears to be a need to use infrastructure spending data in a more analytical manner in order to **monitor unit cost trends**, for instance trends with respect to costs per toilet and classroom. Treasury norms for unit costs exist, but it seems these are not enough to curb over-expenditure on individual projects. There could be instances where spending below the Treasury norms is justified in order to increase the number of schools which can be built or upgraded each year. The National Development Plan argues strongly that high unit costs hold back infrastructure development in the schooling sector⁴³.

The two schools, in two different districts, visited as part of the current project reported vastly different experiences with respect to infrastructure development. One school was satisfied with, for instance, the ability of the department to respond to urgent infrastructure repairs. The other school was very dissatisfied, largely because **planned work had not happened, and no explanation had been given for this**. In other words, the second school needed, in part, more information and transparency. It seems planning in the area of infrastructure, and other areas, needs to be based to a greater degree on systematic and periodic assessments of what schools themselves say. A survey such as Western Cape’s ‘customer satisfaction survey’ would help in this regard.

4.7 Learning materials data

As discussed in section 4.4, around **half of KwaZulu-Natal’s schools enjoy the right to purchase books** and other educational materials themselves, using funds transferred to them by the department. In the case of the other half of schools, the department procures materials on behalf of the school, on the basis of requests from the school, and using a budget set aside for this.

KZNDoE’s book procurement system, which caters for schools which must use this system as well as a large number of schools which have chosen to use it, includes the collection of data on orders from schools. This data collection occurs relatively manually (and not through an

⁴³ National Planning Commission, 2012: 313.

online system as in Western Cape). Once collated and checked, data are forwarded to a **contracted ‘managing agent’**, which manages the actual procurement of materials and deliveries to schools.

One form of corruption KZNDoE officials are concerned about is ‘special agreements’ between schools and specific publishers. School staff, in some schools, select the books of particular publishers in exchange for rewards paid for by the publisher. The most effective way of tackling this type of corruption is to raise the stakes around learner performance, and to strengthen teacher accountability for results. If this occurs, **teachers are less likely to accept books which they believe are not best for learning and teaching** in the classroom.

5 The use of data for more in-depth research

In the Western Cape report, it was argued that a research unit is necessary which is not tied to a specific ‘silo’ in the organisation (for instance human resources, finance, assessments, or infrastructure) and is to some degree separated from labour-intensive annual planning and reporting functions. A critical number of **researchers within this unit would need to be good data analysts**, and should be highly familiar with *all* the data of KZNDoE. In many ways, these researchers should be ‘silo-busters’ who are able to produce useful knowledge which takes into account how different inputs (teacher time, school management practices, textbooks, and assessment results, for instance) are all connected. The knowledge produced should be interesting, but it should also be directly useful in the sense that it should enable to the KZNDoE leadership to take decisions which improve the effectiveness of the schooling system. In the case of KwaZulu-Natal, perhaps the starkest indication that available data are not being used to generate knowledge that decision-makers must have, is the absence of reliable school completion statistics, an absence which seriously distorts perceptions of the strengths and weaknesses of the schooling system (see section 4.1).

Whilst the problem in Western Cape’s department seems to be that the research function is too ‘buried’ within the bureaucracy and tied to a specific function (learner assessments), the problem in KZNDoE is even more serious insofar as **a research function cannot be said to exist anywhere in the organisation**. This is a matter that should be remedied. However, it should be emphasised once again that researchers should have good data analysis skills. KZNDoE is a particularly data-rich organisation, and it must deliver services in a highly complex sector. Not using KZNDoE’s data to a much greater degree than is currently the case would be to represent many lost opportunities.

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Appendix A: Grade 12 results by district

This appendix explores ways of viewing Grade 12 enrolment data in KwaZulu-Natal, with an emphasis on understanding the levels of performance in districts, and the trends seen in the period 2012 to 2015. Moreover, the emphasis is on mathematics, though the methods presented here would be applicable to other subjects. The analysis includes discussion of how the results presented here support or contradict findings in a KZNDoE report from 2015 titled *National Senior Certificate: Accurate lessons from the performance of the “Class of 2014” KwaZulu-Natal Department of Education (2015)*⁴⁴, which examines trends across several subjects between 2013 and 2014. On the whole, the results appearing below support what is found in the KZNDoE report, though there are some noteworthy differences. Often these differences arise because the analysis presented here pays attention to four matters not covered in the KZNDoE (and which arguably should be covered in this type of analysis). The four matters are:

- **Examination of levels of performance of importance to universities.** Whilst passes are important, so is the ability of districts to produce learners with levels of achievement in mathematics which would allow them entry into programmes in universities such as engineering, commerce and medicine. For many universities and programmes, a mark of 60% is considered a threshold.
- **Performance relative to the socio-economic circumstances of schools.** A lower performance statistic in one district relative to another is not necessarily a sign that this district is a poorer performer. It is widely recognised in education monitoring that to some extent results need to be seen relative to the socio-economic circumstances of schools and learners⁴⁵. It is possible to calculate an *expected* Grade 12 outcome for a district based on that district’s socio-economic situation. For the latter, the best data available seem to be the school-level poverty quintiles. Assessing whether a district performs below or above its expected level of performance, and by how much, permits what is in many ways is a fairer and more meaningful comparison across districts.
- **Understanding trends in the context of national ‘declines’.** In many cases, national statistics worsen from one year to the next. Research suggests⁴⁶ that often this is not because the quality of learning and teaching has become worse, but rather because the difficulty of examinations has shifted. In such a situation, an apparent worsening in, say, a district’s performance indicator should be seen relative to the overall national trend. If the national trend is also negative, and a district displays losses which are smaller than what is seen in the national trend, it is possible that the district in question is in fact *improving*, despite the negative change.
- **Paying attention to absolute numbers of achievers.** The ‘pass rate’ (learners passing over learners taking the examination) is a widely quoted statistic in South Africa. Whilst it has its uses, it is also important to examine absolute numbers of achievers. It is fairly easy for the pass rate to be unduly manipulated. This can be done by restricting or encouraging the flow of learners into Grade 12. However, changing a statistic such as the number of learners achieving 60% in mathematics is less easy as this is fairly strongly dependent on changes on practices in the classroom.

The last column of Table 12 below indicates how many public ordinary schools one should expect in the examinations data. Overall, of the 1,624 schools with Grade 12 learners found in the Snap Survey data, 1,612 could be traced in the examinations data. Both figures refer to

⁴⁴ KwaZulu-Natal Department of Education, 2015.

⁴⁵ For a widely referenced South African source on the matter see Crouch and Mabogoane (1998).

⁴⁶ See Gustafsson, 2016b.

schools present in *all* four years in the range 2012 to 2015. The difference of 0.7% is small. The causes for this gap would be mainly that the use of unique school identifiers is not entirely consistent across the two datasets. At the same, this gap is not ideal and official reports should reflect the correct set of schools, with no exclusions.

Table 7: Data coverage of Grade 12 public schools per district 2012-2015

District	Examinations	
	data	Snap data
Amajuba	66	66
iLembe	119	120
Pinetown	140	144
Sisonke	83	83
Ugu	121	121
uMgungundlovu	140	142
uMkhanyakude	144	149
Umlazi	146	147
uMzinyathi	134	135
uThukela	128	128
uThungulu	190	191
Zululand	201	198
KwaZulu-Natal	1,612	1,624

The next four tables provide four key sets of statistics in a standard format. Figures from these tables are used in the discussion of trends which follows. They are all calculated using *learner*-level, and at times *learner and subject*-level raw data (in other words the lowest levels available in the data). Table 8 reflects the number of Grade 12 candidates, regardless of subjects taken. Only full-time examination candidates with at least seven subject marks are counted. The last column of the table indicates the annual percentage growth. This is calculated by dividing the slope by the average across all years. For instance, in the first row (Amajuba) the slope is 916, meaning that if one drew a straight trendline across the four values of the period 2012 to 2015, one would obtain a slope, or an annual increase in the trendline, of 916 learners. One can obtain a slope value by using the **SLOPE** function in Excel (the current report is accompanied by an Excel file where all the tables appearing here are generated). The average number of candidates per year for Amajuba is 7,544. 916 divided by 7,544 gives an annual growth percentage of 12.1%.

Table 8: Grade 12 candidates

	2012	2013	2014	2015	Annual growth (%)
Amajuba	6,361	6,994	7,610	9,209	12.1
iLembe	7,109	8,371	8,271	8,889	6.4
Pinetown	14,403	18,087	17,588	18,860	7.5
Sisonke	5,423	5,866	6,451	6,868	8.0
Ugu	9,120	9,897	9,354	11,533	6.7
uMgungundlovu	11,034	12,331	11,985	12,632	3.7
uMkhanyakude	9,732	9,653	9,543	12,559	8.1
Umlazi	17,166	21,726	19,877	19,631	2.8
uMzinyathi	7,222	8,183	7,716	9,457	7.7
uThukela	8,346	9,323	9,091	10,827	7.7
uThungulu	13,881	16,285	15,484	17,378	6.1
Zululand	12,917	14,766	15,130	16,851	8.2
KwaZulu-Natal	122,714	141,482	138,100	154,694	6.6
KZN quintile 1	21,381	23,166	22,788	27,258	7.3
KZN quintile 2	29,665	32,750	33,007	38,702	8.2
KZN quintile 3	30,138	33,437	34,813	40,448	9.3
KZN quintile 4	20,950	24,718	23,371	25,727	5.5
KZN quintile 5	20,571	27,398	24,101	22,544	1.1
South Africa	479,743	530,174	500,669	595,242	6.0

Note: The current table and the tables that follow cover only public ordinary schools.

Table 9 reflects the number of those from the previous table who wrote the mathematics examination.

Table 9: Mathematics candidates

	2012	2013	2014	2015	Annual growth (%)
Amajuba	2,922	3,374	3,716	4,144	11.3
iLembe	3,473	3,857	4,415	4,932	11.8
Pinetown	6,502	8,096	6,966	7,363	2.0
Sisonke	2,492	2,597	2,642	2,824	3.9
Ugu	4,159	4,214	3,958	5,311	7.3
uMgungundlovu	4,725	5,427	5,147	5,394	3.3
uMkhanyakude	4,494	4,496	4,778	6,032	9.9
Umlazi	8,970	11,719	10,101	9,769	0.8
uMzinyathi	3,695	4,166	4,699	5,961	15.8
uThukela	3,975	4,324	4,407	5,886	12.5
uThungulu	7,834	9,236	9,299	10,904	10.0
Zululand	6,966	8,654	9,317	11,359	15.3
KwaZulu-Natal	60,207	70,160	69,445	79,879	8.3
KZN quintile 1	11,061	12,457	13,859	17,255	14.6
KZN quintile 2	13,776	15,296	16,035	20,109	12.1
KZN quintile 3	14,007	15,245	16,297	19,204	10.3
KZN quintile 4	10,750	13,069	11,734	12,540	3.4
KZN quintile 5	10,604	14,080	11,500	10,756	-1.8
South Africa	209,585	225,246	209,460	240,760	3.5

Table 10 indicates how many mathematics candidates obtained at least the 30% pass mark.

Table 10: Mathematics passes (at 30% mark)

	2012	2013	2014	2015	Annual growth (%)
Amajuba	1,738	2,018	1,588	1,679	-3.5
iLembe	1,213	1,578	1,091	906	-11.8
Pinetown	3,303	4,694	3,313	2,932	-7.0
Sisonke	881	1,104	879	911	-1.4
Ugu	1,809	2,076	1,616	1,532	-7.3
uMgungundlovu	2,290	3,031	2,460	2,220	-3.1
uMkhanyakude	1,618	1,992	1,682	1,777	0.9
Umlazi	5,135	6,824	4,802	4,514	-7.3
uMzinyathi	1,736	2,005	1,437	1,347	-10.6
uThukela	1,800	2,343	1,860	1,875	-1.3
uThungulu	3,191	4,221	3,035	2,701	-8.1
Zululand	3,455	4,481	3,272	3,115	-6.2
KwaZulu-Natal	28,169	36,367	27,035	25,509	-5.9
KZN quintile 1	4,515	5,570	3,947	3,561	-10.2
KZN quintile 2	5,357	6,897	5,355	5,065	-4.3
KZN quintile 3	5,302	6,654	5,315	5,271	-2.5
KZN quintile 4	5,103	6,833	4,883	4,708	-5.8
KZN quintile 5	7,885	10,402	7,519	6,890	-7.2
South Africa	110,142	128,663	107,639	113,858	-0.9

Finally, Table 11 indicates how many mathematics candidates obtained a mark of at least 60%.

Table 11: Mathematics learners achieving at least 60% mark

	2012	2013	2014	2015	Annual growth (%)
Amajuba	374	468	320	336	-7.0
iLembe	156	266	153	137	-9.6
Pinetown	940	1,462	985	803	-8.5
Sisonke	90	153	100	107	-0.2
Ugu	339	448	294	270	-10.7
uMgungundlovu	564	799	565	540	-5.0
uMkhanyakude	208	326	203	218	-3.9
Umlazi	1,678	2,443	1,502	1,392	-10.3
uMzinyathi	157	274	123	211	0.6
uThukela	300	477	313	332	-1.9
uThungulu	498	727	364	416	-12.1
Zululand	458	673	455	391	-8.5
KwaZulu-Natal	5,762	8,516	5,377	5,153	-8.0
KZN quintile 1	363	633	319	359	-7.8
KZN quintile 2	581	933	592	603	-4.1
KZN quintile 3	732	1,196	786	799	-2.4
KZN quintile 4	1,177	1,840	1,138	1,043	-8.5
KZN quintile 5	2,907	3,908	2,535	2,342	-10.5
South Africa	27,163	33,729	26,903	27,930	-1.6

Table 12 below uses figures from three of the tables above (all except for Table 10). It also uses figures from Table 13, which reflects the average (across the four years) in the number of Grade 12 candidates per province and quintile. Raw pass ratios in Table 12 simply reflect achievers over a denominator across all four years. For instance, in Amajuba the sum of all learners achieving 60% in mathematics, across the four years (from Table 11) divided by the sum across the four years of the number of mathematics candidates (from Table 9) comes to 11%.

Table 12: Mathematics achievement after controlling for quintile composition

	Passes over mathematics candidates			Achievement at 60% over mathematics candidates			Achievement at 60% over all examination candidates		
	Raw	Expected	Relative	Raw	Expected	Relative	Raw	Expected	Relative
Amajuba	50	43	6.8	11	10	0.9	5.0	4.8	0.2
iLembe	29	38	-9.1	4	7	-2.3	2.2	3.2	-1.1
Pinetown	49	48	1.1	14	13	1.7	6.1	6.3	-0.2
Sisonke	36	35	0.4	4	5	-0.6	1.8	2.4	-0.6
Ugu	40	39	1.4	8	7	0.9	3.4	3.4	0.0
uMgungundlovu	48	45	3.1	12	11	0.9	5.1	5.4	-0.3
uMkhanyakude	36	34	1.6	5	4	0.8	2.3	2.1	0.2
Umlazi	52	55	-2.6	17	17	0.6	8.9	8.3	0.7
uMzinyathi	35	35	0.0	4	5	-0.7	2.3	2.5	-0.2
uThukela	42	38	4.2	8	7	0.8	3.8	3.4	0.4
uThungulu	35	40	-4.9	5	8	-2.4	3.2	3.9	-0.7
Zululand	39	35	4.2	5	5	0.4	3.3	2.5	0.8
KwaZulu-Natal	42			9			4.5		
KZN quintile 1	32			3			1.8		
KZN quintile 2	35			4			2.0		
KZN quintile 3	35			5			2.5		
KZN quintile 4	45			11			5.5		
KZN quintile 5	70			25			12.4		
South Africa	52			13			5.5		

The ‘Expected’ values in Table 12 are relatively complex, but in a nutshell they are intended to capture what a district *should* achieve, given its quintile breakdown, and given the average performance per quintile in KwaZulu-Natal. For instance, we expect Amajuba’s mathematics passes over mathematics candidates to come to 43% on the basis of the following calculation:

$$\frac{(E_{d,1} \times R_{p,1}) + (E_{d,2} \times R_{p,2}) + (E_{d,3} \times R_{p,3}) + (E_{d,4} \times R_{p,4}) + (E_{d,5} \times R_{p,5})}{E_d}$$

Here enrolment E in the district d , or Amajuba, in quintile 1 (from Table 13) is multiplied by the raw pass ratio R for quintile 1 in the province (32%, in Table 12). This is then added to enrolment in Amajuba, in quintile 2 multiplied by the raw pass ratio for quintile 2 in the province (35%). And so on, until the numerator is obtained. The denominator E_d is the enrolment for Amajuba seen in the last column of Table 13.

The ‘Relative’ values in Table 12 are simply the difference between ‘Raw’ and ‘Expected’. A positive ‘Relative’ value means the district performs better than one might expect, because the ‘Raw’ (or actual) is greater than the ‘Expected’.

Table 13: Grade 12 candidates per district and quintile

	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	Total
Amajuba	51	1,196	2,642	2,674	981	7,544
iLembe	1,945	2,076	2,643	932	577	8,172
Pinetown	0	759	6,250	5,081	5,133	17,223
Sisonke	1,023	3,570	1,187	282	91	6,152
Ugu	1,854	4,601	1,718	880	957	10,009
uMgungundlovu	237	2,254	4,564	1,848	3,097	12,000
uMkhanyakude	3,739	5,353	1,068	222	0	10,381
Umlazi	25	277	2,677	7,356	9,320	19,655
uMzinyathi	4,398	1,843	1,134	720	219	8,313
uThukela	1,763	2,121	3,925	757	832	9,397
uThungulu	3,686	5,424	2,977	1,366	2,326	15,780
Zululand	5,261	4,068	3,982	1,574	159	15,043

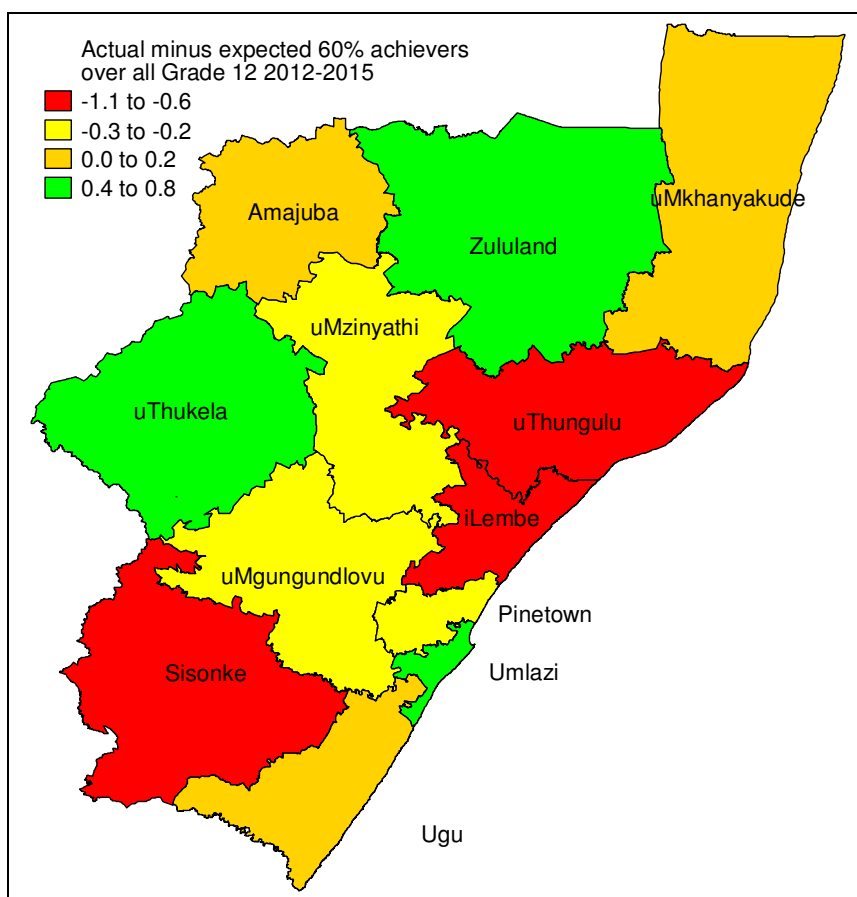
Note: Each value is the average across the years 2012 to 2015.

What follows is the actual analysis based on the figures seen above.

The next map (Figure 6) reflects figures from the last column of Table 12, meaning how well a district has performed, relative to its expected level, in terms of mathematics passes at the 60% level over all examination candidates. Broadly speaking, the map produces findings which are similar to those of the KZNDoE report. For instance, in both analyses iLembe emerges as a district with particularly low performance in mathematics⁴⁷. One noteworthy difference is that though uMzinyathi emerges as the second-worst district in the KZNDoE report, after iLembe, on the basis of the mathematics pass rate, uMzinyathi is a bit better positioned in the Figure 6 map – here it is ‘just’ fifth-worst. The main difference for this difference is not that the KZNDoE report uses the pass rate whilst the map below refers to passes at a 60% mark threshold. The difference is mainly due to the fact that uMzinyathi is a particularly poor district, in fact the second-poorest after uMkhanyakude if one takes the average quintile per learner. Thus expectations are rather low for uMzinyathi (see the columns ‘Expected’ in Table 13).

⁴⁷ Page 30 of the KZNDoE report.

Figure 6: LEVEL of mathematics performance by district



Note: Values used for graph are those from the last column of Table 12.

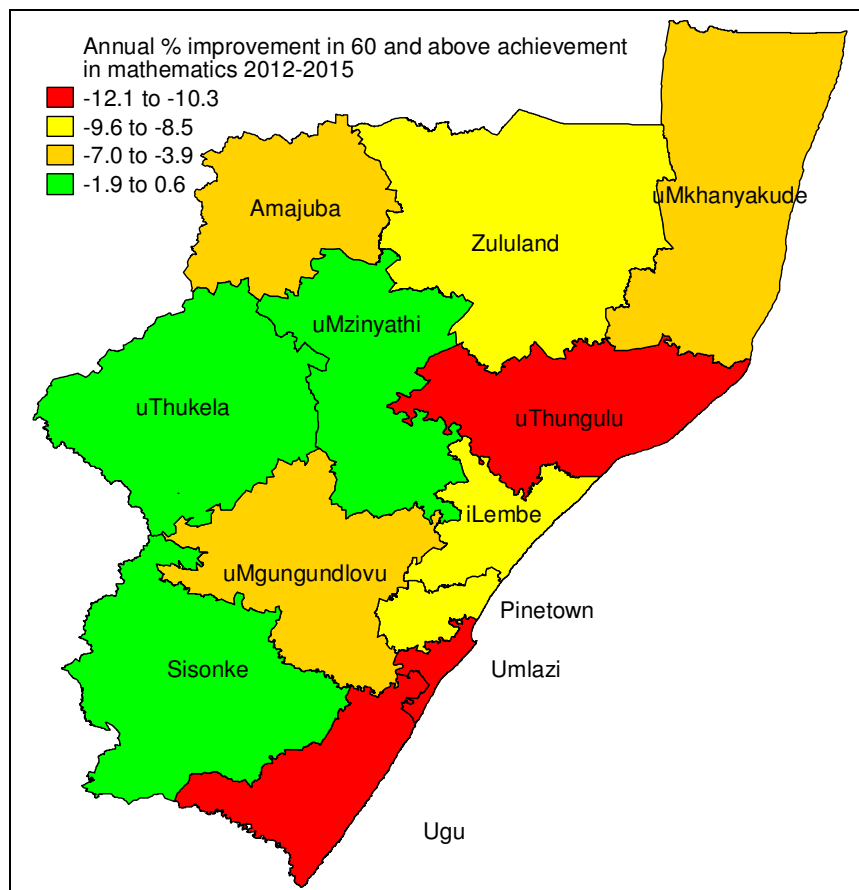
To a large degree the findings with regard to *trends* reflected in Figure 7 below agree with the corresponding findings in the KZNDoe report. However, there are interesting differences. In particular, the KZNDoe report finds that uMzinyathi is experiencing particularly serious declines in mathematics⁴⁸, whilst Figure 7 puts this district amongst the best three in terms of mathematics trends. A part of the explanation lies in the fact that the KZNDoe report refers to passes at a 30% pass level, whilst the map below refers to attainment of a mark of 60%. It is true that uMzinyathi saw declines in the number of mathematics passes which were much worse than the decline in the province, as seen in the 10.6% annual decline for uMzinyathi in Table 10 against a decline of 5.9% for the province. On the other hand, growth in the number of learners achieving 60% in uMzinyathi was a slightly positive 0.6% a year, against a decline of 8.0% for the province (see Table 11).

A second reason for the difference across the two reports is that the 2013 to 2014 trend for uMzinyathi was particularly bad whilst the longer-term trends were better, whether one considers 2012 to 2014 or 2012 or 2015. Short-term trends should be monitored, but they should be viewed in conjunction with longer-term trends, partly to avoid what could be called false alarms. A trend across two years is more likely to reflect fairly random factors which have nothing to do with the quality of learning and teaching, relative to a trend across three or four years. Examples of these factors would be troughs and peaks in the population of youths (in other words demographic factors), and local natural disasters which affected learner attendance (but not the quality of learning and teaching in any fundamental way).

⁴⁸ Page 12 of that report.

Thirdly, the graph is based on trends in the *absolute number* of learners achieving a mark, not the ratio of these learners over total mathematic candidates, in other words not the pass rate. If one examines learners achieving 60% over mathematics candidates, uMzinyathi does not emerge as an improver. This is because for some reason uMzinyathi's participation in mathematics increased markedly, to a greater degree than in other districts. As seen in Table 9, participation in mathematics rose by a whole 15.8% a year, which was more than any other district, and faster than the increase in the number of Grade 12 learners (see Table 8). Unless there were dramatic and exceptional improvements in the teaching of mathematics in grades 8 to 11 in this district, something which is not very likely, one cannot expect the increase in the number of candidates to translate into a commensurate increase in the number of learners achieving a mark of 60%. In many respects, what is important is the fact that the trend for the *absolute number* of high-level achievers was positive, whilst it was negative for every other district.

Figure 7: TREND in mathematics performance by district



Note: Values used for graph are those from the last column of Table 11.

Appendix B: Monitoring large year-on-year Grade 12 pass fluctuations

This appendix explores ways of assessing where Grade 12 pass rate increases between one year and the next could be strangely large, a matter which has been of interest to KZNDoE. In part, the focus is on finding better ways of performing this assessment and in part the focus is on concluding whether the situation in KwaZulu-Natal in this regard is exceptional in a national context, and whether any districts in the province display noteworthy patterns.

KZNDoE has, in its reports, flagged schools with exceptionally large positive shifts in their pass rate. Table 14 displays the percentage of Grade 12 learners, per province, in schools where the pass rate increase between 2014 and 2015 exceeds 35 percentage points. Importantly, the statistic in the first column is not the percentage of *schools*. Such an approach could be deceptive if small schools display different patterns to larger schools. A threshold of a 35 percentage point increase was chosen because nationally almost exactly one per cent of learners were in schools where the increase exceeded this threshold. Whilst in KwaZulu-Natal 1.3% of Grade 12 learners were in schools with a pass rate increase exceeding the threshold, a similar situation prevailed in other provinces, including Free State, Mpumalanga and North West. The prevalence of possibly suspicious pass rate changes was thus not particularly high in KwaZulu-Natal.

Table 14: Exceptional pass rate increases 2014-2015

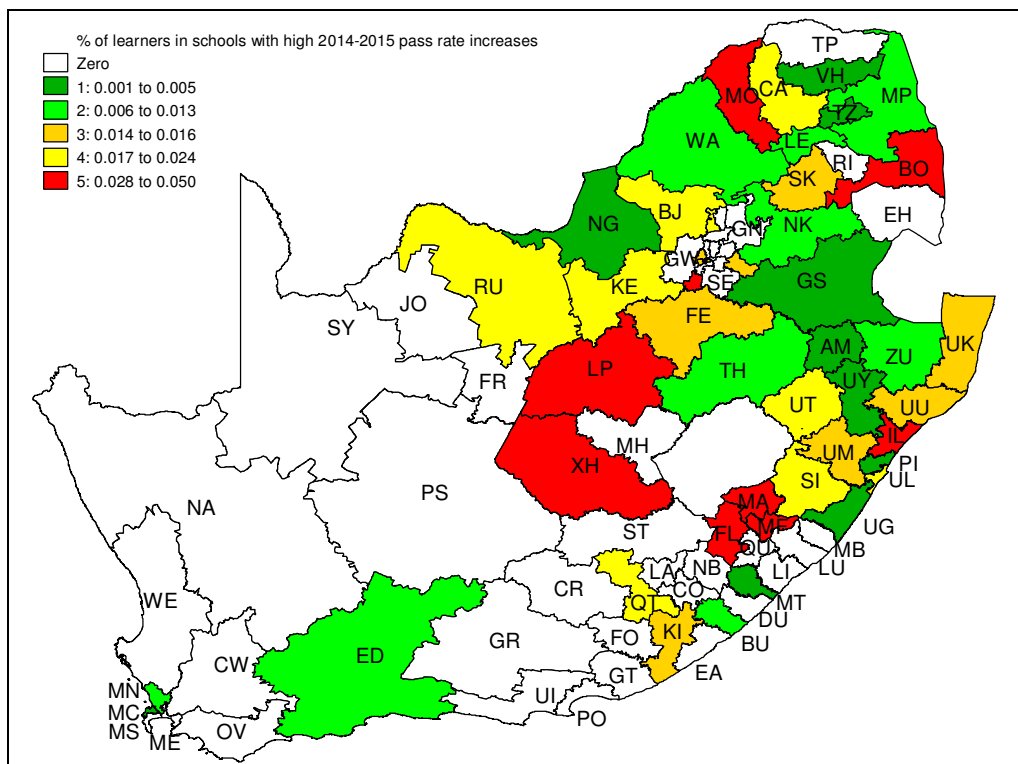
	% of learners in schools with a pass rate increase exceeding 35 percentage points (A)	% of learners in schools with a pass rate decrease exceeding 46 percentage points (B)	A minus B
EC	0.6	3.0	-2.3
FS	1.4	0.1	1.3
GP	0.6	0.0	0.6
KN	1.3	1.6	-0.2
LP	1.1	1.1	0.0
MP	1.3	0.5	0.9
NC	0.0	0.0	0.0
NW	1.6	0.1	1.6
WC	0.3	0.0	0.3
SA	1.0	1.0	0.0

The second column of Table 14 displays the percentage of learners in schools where the pass rate *declined* by more than 46 percentage points between 2014 and 2015. Again, the total in the bottom line, for the country, is 1.0% of all learners. The first and second columns together provide an indication of how much general variability there is in the pass rate, either positive or negative. We see that in KwaZulu-Natal the number of schools with rather large increases *and decreases* in the pass rate is somewhat high, relative to the national situation, suggesting that the large *increases* are evidence of the general volatility in the pass rate, not school-level upward manipulation of the pass rate. The third column displays the difference between the first two columns and thus indicates the degree to which increases exceed decreases and the grounds that may exist for believing there is undue manipulation of the pass rate of some kind or another by schools. Here KwaZulu-Natal's measure is below the national level, suggesting there is nothing exceptional about the prevalence of large pass rate increases between 2014 and 2015 in the province.

Figure 8 below illustrates the values at the district level for the statistics of the first column of Table 14. Ilembe (IL) is the district with the highest value in KwaZulu-Natal, but this district is not dissimilar to a few other districts in the rest of the country. (Many districts across the country display a value of zero because no schools experienced a pass rate increase exceeding the threshold.) Figure 9 displays the district-level values for the statistic seen in the third

column of Table 14. The picture across the two graphs is fairly similar, at least for KwaZulu-Natal.

Figure 8: Exceptional pass rate increases 2014-2015 (I)



Source: Grade 12 examinations data of the DBE.

[illegible]

Appendix C: The cost of educator benefits in November 2015

Table 15 below provides details on the payments of benefits, using Persal payroll data from November 2015. Above all, the analysis is intended to confirm that in total benefits do not come to 37% of basic pay. In fact, nationally they come to 31.9% of basic pay. Only permanently employed educators are considered in the analysis. Average Rand values are annualised, meaning monthly figures are multiplied by 12 months (except in the case of the service bonus, which is not received by all employees every month). If the uptake came to 100% for the medical and housing categories, the bottom right value would rise from 31.9% to 35.0%. The gap between 35.0% and the 37% rule of thumb commonly used would be accounted for largely by the fact that some employees receive a benefit amount, for instance with respect to medical aid, which is below the maximum they could receive.

Table 15: Breakdown of benefits in November 2015

		Pension			Service bonus			Medical			Housing			Other (including remoteness incentive, qualifications bonus, long service award, employer's contribution to ELRC ⁴⁹)			Sum of all *
		Avg. per recipient	% uptake	% over basic*	Avg. per recipient	% uptake	% over basic*	Avg. per recipient	% uptake	% over basic*	Avg. per recipient	% uptake	% over basic*	Avg. per recipient	% uptake	% over basic*	
Basic pay																	
EC	265,194	35,960	100	13.6	22,078	100	8.3	22,602	75	6.4	10,814	88	3.6	3,608	100	1.4	33.2
FS	271,657	35,469	100	13.1	22,631	100	8.3	24,276	79	7.1	10,808	82	3.3	1,590	100	0.6	32.3
GP	275,793	35,902	100	13.0	22,794	100	8.3	23,836	75	6.5	10,828	83	3.3	716	100	0.3	31.3
KN	265,072	34,606	100	13.1	21,914	100	8.3	23,725	77	6.9	10,850	81	3.3	1,243	100	0.5	32.0
LP	270,619	35,229	100	13.0	22,291	100	8.2	24,376	57	5.2	10,801	88	3.5	3,881	100	1.4	31.3
MP	267,089	34,804	100	13.0	22,142	100	8.3	23,974	68	6.1	10,809	90	3.6	1,488	100	0.6	31.6
NC	276,627	36,210	100	13.1	23,383	100	8.4	23,612	76	6.5	10,814	83	3.2	3,901	100	1.4	32.7
NW	267,471	36,508	100	13.6	22,492	100	8.4	24,564	76	7.0	10,829	81	3.3	869	100	0.3	32.7
WC	278,082	36,200	100	13.0	22,920	100	8.2	22,926	74	6.1	10,860	69	2.7	1,479	100	0.5	30.6
SA	269,242	35,433	100	13.2	22,308	100	8.3	23,666	72	6.3	10,825	83	3.3	2,094	100	0.8	31.9

Note: '% over basic*' is total spending on the benefit divided by total spending on basic pay, with the basic pay of all employees counted, even those not taking up the benefit.

⁴⁹ Education Labour Relations Council.