ACCOUNTABILITY AND CAPACITY IN SOUTH AFRICAN EDUCATION[1]

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ABSTRACT

The aim of the study is to discuss the notion of accountability with respect to education in South Africa. Starting with an overview of the international literature on accountability, the article then turns to the South African context and focuses on one particular capacity constraint as an illustrative example: low mathematics teacher content knowledge. After explaining two important problems identified in the literature – accountability without capacity and capacity without accountability – the focus becomes what needs to be done in South Africa to improve accountability. In this vein, a useful analytic framework is proposed – that of Hausmann *et al.'s* (2008) 'binding constraints approach', as well as a discussion of the central importance of the Annual National Assessments (ANAs) and the need to balance the rights and concerns of children and teachers. The main thesis of the article is that the wholesale lack of accountability for student learning outcomes in South Africa is arguably one of the major impediments to quality education for the poor.

Keywords: accountability, capacity, learning outcomes, mathematics teacher content knowledge

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INTRODUCTION

In South Africa, there is a widespread perception that the national, provincial and local levels of government are not held accountable for how they use public resources. As democratically elected representatives of the people, each of these levels has a constitutional mandate to use tax revenues and other state resources to provide certain public services to South Africans. Often, however, for reasons that range from poor administration to corruption, these resources are not converted into public services. Furthermore, given that there are few (if any) tangible consequences for non-performance, there now exists a cycle of poor service delivery, weak accountability and low expectations. This lack of accountability and service delivery is especially acute in the basic education sector in South Africa. One of the ten 'critical actions' outlined in the National Development Plan (NDP) of the National Planning Commission (NPC) is the creation of an 'education accountability chain', because 'education outcomes cannot improve unless accountability is reinforced throughout the system, from learner results to the delivery of textbooks' (NPC 2012: 55).

The aim of the present analysis is to discuss the notion of accountability with respect to education in South Africa. Starting with an overview of the international literature on accountability, the article then turns to the South African context and focuses on one particular capacity constraint as an illustrative example: low mathematics teacher content knowledge. After explaining two important problems identified in the literature – accountability without capacity and capacity without accountability – the focus becomes what needs to be done in South Africa to improve accountability.

ACCOUNTABILITY

An overview of the international literature on accountability in education shows economists and educationists making different sense of the issue. Economists highlight the importance of information, choice, incentives and decentralisation (see, for example, Bruns, Filmer & Patrinos 2011). Educationists, in contrast, argue that capacity building and support should precede accountability (Elmore 2004a). These differences stem largely from differing *a priori* assumptions about teachers, principals and schools, as Taylor, Van der Berg and Mabogoane (2013:24) note:

> The traditions of school effectiveness research and the economics of education bring complementary perspectives to bear. While the former assumes that individual actors, and in particular school principals and teachers, are motivated by altruism and the desire to do the best for the learners in their care, economists assume that actors are motivated largely by self-interest. Taken together, these views sound like a good description of human behaviour.

In keeping with this line of thinking, the present analysis draws from both literatures in an attempt to understand how accountability should be conceptualised and implemented in the South African context.

What is accountability?

Darling-Hammond and Ascher (1991: 2) regard an accountability system to be a

> set of commitments, policies and practices that are designed to: 1) heighten the probability that students will be exposed to good instructional practices in a supportive learning environment; 2) reduce the likelihood that harmful practices will be employed; and 3) provide internal self-correctives in the system to identify, diagnose, and change courses of action that are harmful and ineffective.

In terms of this conceptualisation, it follows that accountability can be defined as the state of being answerable for something to someone. It refers to having to account for one's outcomes or performance and to accept responsibility for those outcomes. It also implies that there are consequences for non-performance. In education, there is a significant body of research that suggests a serious need for increased accountability, particularly in developing countries. Bruns *et al*. (2011), in their influential book, *Making schools work*, point to high levels of teacher absenteeism, funding leaks and inefficiencies, as well as the very weak correlation between spending and outcomes, as tell-tale signs of a weak accountability system. They see these problems as arising primarily out of a lack of information and incentives; and, consequently, their solutions are primarily administrative in nature. These solutions include:

- Information for accountability: generation and dissemination of information about schooling rights and responsibilities, inputs, outputs, and outcomes.
- School-based management: decentralization of school-level decision making – autonomy – to school-level agents.
- Teacher incentives: policies that link pay or tenure directly to performance (Bruns *et al*. 2011:13).

Many of the generic accountability problems they identify are also prevalent in the South African context. Taylor (2002:12), in commenting on South Africa's public schooling system, highlights the'vast slack of inefficiency and corruption which bloats every corner of the enterprise of public schooling'. Local research on three particular problems – teacher absenteeism, low curriculum coverage (inefficient time use) and insufficient information for accountability – supports this conclusion:

1. *Teacher absenteeism.* A 2010 study by the Human Sciences Research Council found that 'a conservative, optimistic leave rate of educators in South Africa is between 10% and 12%' (Reddy *et al*. 2010:84), which amounts to 20–24 days per year for the average teacher. The study also reveals that slightly more than 'three-quarters of all leave instances recorded on the PERSAL[2] system

2 PERSAL is the personnel salary system used by the Department of Basic Education.

are for one or two days in duration, that is, discretionary leave not requiring a medical certificate. Mondays and Fridays are the most popular discretionary leave days' (Reddy *et al.* 2010:x). Spaull (2011), using the Southern and Eastern African Consortium for Monitoring Educational Quality (SACMEQ) 2007 data, finds that the average Grade 6 mathematics teacher in South Africa reported being absent from school for 19 days. This was much higher in the poorest 20 per cent of schools (23 days), compared with the wealthiest 20 per cent of schools (11 days). While it is true that there were severe teacher strikes in 2007, which inflated the absenteeism figures, these were also self-reported rates of absenteeism and, thus, were almost certainly under-reported.

2. *Low curriculum coverage*. A 2009 study observing 58 schools in the North West concluded that 'teachers did not teach 60% of the lessons they were scheduled to teach' in the year (Carnoy, Chisholm & Chilisa 2012:xvi). Similarly, in 2008 and 2009, the National School Effectiveness Study (NSES) showed that in a nationally[3] representative sample, only 24 per cent of Grade 4 and 5 topics were actually covered in Grade 4 and 5 classrooms in South Africa (Taylor & Reddi 2013). This is for a variety of reasons, including teacher absenteeism, poor time management and a lack of a culture of teaching and learning.
3. *Insufficient information for accountability*. Prior to 2011, the only nationally standardised exams that existed in South Africa were at the exit level of the schooling system (matric). In response to this serious lack of information on primary school performance, the Department of Basic Education (DBE) implemented the Annual National Assessments(ANAs) in 2011, which tested all school children in Grades 1–6 and 9 using nationally standardised exams. However, as they are currently implemented, these exams are fraught with serious problems, which are discussed in more detail later in this article.

In addition to the above, perhaps the most convincing evidence of a serious lack of accountability in the education system is the weak correlation between increased expenditures and improved educational outcomes. Van der Berg (2007:849) notes that, 'despite massive resource shifts to black schools, overall matriculation results did not improve in the post-apartheid period'. Given that South Africa participates in a number of cross-national assessments of educational achievement, it is useful to provide a broad outline of the country's performance relative to other countries on the continent and around the world. The three major cross-national assessments are the Progress in International Reading Literacy Study (PIRLS – Grade 4 and 5), the Trends in International Mathematics and Science Study (TIMSS – Grade 8 and 9) and the SACMEQ (Grade 6). Each of these is discussed separately below:

3 Gauteng was the only province that did not participate in the NSES, since other tests were being administered there at the same time.

- *PIRLS*: In the 2006 round of PIRLS, South African Grade 5 students achieved the lowest score of the 45 countries that participated (and almost all other countries tested their Grade 4 students), including other middle-income countries such as Morocco, Iran, Trinidad and Tobago, Indonesia and Macedonia. Seventy-eight per cent of South African Grade 5 students were not minimally competent in reading, that is to say that they did not reach the Low International Benchmark. Trong (2010:2) elucidates the practical value of this benchmark: 'Learners who were not able to demonstrate even the basic reading skills of the Low International Benchmark by the fourth grade were considered at serious risk of not learning how to read.' In response to the extremely weak performance of South African students in PIRLS 2006, South Africa opted to take part in the 2011 pre-PIRLS, which is an easier assessment (primarily for developing countries) rather than the PIRLS of 2011. Although South African Grade 4 students performed similarly to Grade 4 students in Botswana, they were almost three years (2.9) behind the average child in Columbia. This was in spite of the fact that public current expenditure on primary education per pupil was 49 per cent higher in South Africa (US$1 685) than it was in Columbia (US$1 132),using 2010 figures for expenditure from the 2012 *Education for all* report (UNESCO 2012).
- *SACMEQ:*South Africa's performance relative to poorer African countries highlights that having additional financial resources does not in any way guarantee better outcomes. Using the SACMEQ 2000 and SACMEQ 2007 data, Van der Berg *et al*. (2011:4) conclude that 'South Africa performed slightly below the average of the other participating African countries in Grade 6 mathematics and reading, despite benefiting from better access to resources, more qualified teachers and lower pupil-to teacher ratios.' Similarly, Spaull and Taylor (2015) show that South African Grade 6 children perform significantly worse than Kenyan Grade 6 students, even after accounting for higher rates of non-enrolment and dropout in Kenya. This is in spite of the fact that in 2007 public current expenditure per pupil was five times higher in South Africa (US$1 225) than it was in Kenya (US$258), using 2007 expenditure figures from the 2010 *Education for all* report (UNESCO 2010) (see also Taylor and Spaull 2015).

4. *TIMSS:* Given that South Africa participated in the 1995, 1999, 2002 and 2011 TIMSS studies, these datasets provide for the most extensive comparison of South African performance since the transition. The TIMSS study testing mathematics and science showed that there was no improvement in Grade 8 mathematics or science achievement between 1995 and 2002. Subsequently, it was decided that the international Grade 8 tests were too difficult for South African Grade 8 students; thus, in 2002, both Grade 8 and Grade 9 students wrote the Grade 8 test, and in 2011 only Grade 9 students wrote the grade eight test. Comparing the performance of Grade 9 students in 2002 and 2011 showed

> that there was an improvement in maths and science performance amounting to approximately one and a half grade levels of learning (Reddy *et al*. 2012). While this offers hope, it is difficult to celebrate when one considers how low the post-improvement level of performance really is. For example, in 2011 one-third (32 per cent) of South African students performed worse than guessing (i.e., no better than random) on the multiple-choice items. Furthermore, three-quarters (76 per cent) of Grade 9 students in 2011 still had not acquired a basic understanding of whole numbers, decimals, operations or basic graphs, and this is at the improved level of performance. Part of the reason for the improvement is the fact that South Africa started from an exceedingly low base in 2002. To place this in perspective, South Africa's post-improvement level of performance is still the lowest of all participating countries, with the average South African Grade 9 child performing between two and three grade levels lower than the average Grade 8 child from other middle-income countries (Spaull 2013).

Following this discussion of results from the cross-national assessments in which South Africa participates, it is helpful to include a caveat about the conceptualisation of 'quality' and accountability. In any discussion of accountability there is an inherent view of what education is for. If we choose to measure only numeracy and literacy, and hold schools accountable for these outcomes alone, this sends a strong signal to students, teachers and principals that these are the most important parts of education. This view is summarised in the saying that we 'measure what we value and we value what we measure'. The view put forward in this article is that although education quality cannot be *solely* proxied by numeracy and literacy scores, these are important components of a quality education and they should be measured. It is not possible to create a single indicator of 'quality' for which students, teachers and principals should be held accountable. This is because it is not possible to create a single metric that encompasses all the attributes of education that the public would agree constitutes a quality education, primarily because some elements are currently very difficult to measure. Such a measure would have to include measures of artistic creativity, empathy, democratic values, preference for political participation, the extent to which schooling successfully socialises children into their societies, whether children have an increased appreciation for social diversity, inclusivity, and the importance of egalitarian principles (attitudinal modernity) (Heneveld and Craig 1996; UNESCO 2005:30).

Types of accountability

The most pertinent literature on this topic distinguishes between various types of accountability. Darling-Hammond and Ascher (1991) identify five different types of accountability mechanisms that operate alongside one another: political accountability, legal accountability, bureaucratic accountability, professional

accountability and market accountability. For the purposes of this discussion, the two most relevant forms are bureaucratic accountability and professional accountability, although legal accountability is becoming increasingly prominent in the basic education sector in South Africa.

Bureaucratic accountability involves promulgating laws and regulations that specify norms and standards of exactly what agents must do. The promotion of standard procedures aims to ensure standardisation across the system. In South Africa, one could argue that bureaucratic forms of accountability could work well in regulating teacher absenteeism and in monitoring textbook procurement and delivery. These forms of accountability are effective to the extent that one can prescribe rules for practice and codify exactly what must be done, in what order and at what time. Doing so can ensure that agents respond in identical and predictable ways (Darling-Hammond & Ascher 1991). However, bureaucratic forms of accountability work less well when trying to regulate the complex process of teaching and learning in the classroom. As Bruns *et al.* (2011:10) explain:

> If education were like producing pizzas or kebabs or samosas or empanadas, the delivery process could be reduced to a set of predefined tasks that agents are instructed to carry out. Quality could be monitored by ensuring that workers follow the predefined steps. But education services are complicated. At the point of delivery – the interaction of teachers with the students – the service provided is highly discretionary, variable, and transaction-intensive:
>
> - Discretionary, in that teachers must use their own judgement to decide what part of the curriculum to deliver and how,
> - Variable, in that in a single classroom a teacher must customize services to a large number of different students with different aptitudes, motivations and learning styles,
> - Transaction-intensive, in that producing learning results requires repeated and frequent interaction between teachers and individual students.
>
> These features make it difficult to predefine in sufficient detail the actions teachers must take, either to specify a complete contract of what they are expected to do or to monitor that contract completely Bruns *et al.* (2011:10).

It is within this context that most educational researchers recognise the importance of professional accountability in education. It shifts the focus away from specifying the minutiae of procedures and standards and moves towards a reliance on professional knowledge and judgement, as well as mutual accountability among those in the profession. In South Africa, there is growing consensus that there is currently a severe lack of professional accountability among teachers, especially within teacher unions, and that there is a need to promote it (NPC2012; NEEDU 2013).

Following on from the above, it is important to be more circumspect when discussing accountability in South Africa. Saying that there is a need for 'more accountability' without specifying what forms of accountability, and to what end, is not very helpful. It is true that in South Africa we need both more professional accountability and more bureaucratic accountability, but the latter will only be able to solve administrative, logistical problems such as teacher absenteeism and textbook procurement. To the extent that desirable teaching and learning cannot be prescribed by rules and procedures, increasing bureaucratic accountability to improve the amount of learning in the classroom will not yield much. Given that increasing the volume and quality of learning that takes place in the classroom is the current central concern in South Africa, it is imperative to understand what forms of accountability will lead to such an increase, and, conversely, what the existing constraints are to increasing the volume and quality of teaching and learning. This is where the 'new accountability' movement in the education literature is particularly helpful.

In contrast to the World Bank approach, which stresses incentives and information (Bruns *et al*. 2011), the key insight from the 'new accountability' movement is that capacity precedes accountability. While increasing information and incentives may improve teacher effort (e.g., attendance), it does not follow that increasing information and incentives will increase the number of topics taught, for example. This is especially the case if the reason the teacher is not teaching those additional topics is because he or she *can't* teach them, rather than because he or she *won't*. Thus, there is an important distinction between capacity and willingness. The 2012 report by the National Education Evaluation and Development Unit (NEEDU) makes this same distinction and argues that different solutions are required, depending on the diagnosis. If it is a case of *teachers won't*, this requires institutional solutions, while if it is a case of *teachers can't*, this requires capacitation solutions (NEEDU 2013). As is argued in the report, South Africa is beset by both types of problems, and indeed they are frequently mutually reinforcing. The remainder of this article will focus on the capacitation issues surrounding accountability, and then will outline in more detail one such capacitation issue that is clearly problematic in South Africa – weak mathematics teacher content knowledge.

ACCOUNTABILITY WITHOUT CAPACITY

In the 'new accountability' literature, perhaps the most eminent and prolific scholar is Harvard University's Richard Elmore. One of his key insights relates to the capacity of principals and teachers, and how this capacity is a prerequisite for schools and teachers to respond to external accountability systems. To stress this notion, Elmore (2008: 43) defines capacity as 'the fund of skill and knowledge that the organization can bring to bear in responding to external pressure'. Both Elmore (2004b) and Loveless (2005) note that schools and teachers need to know what to do when faced

with information that they are underperforming. They argue that simply lobbying for 'incentives to improve performance' is simplistic and naive since it presumes that teachers and principals know how to improve performance – something that may not in fact be true. If, for example, a teacher is not covering certain topics because he or she does not understand the content, no amount of incentives will work unless they are incentives to take advantage of opportunities to acquire the skills and knowledge needed to teach those content areas (capacitation). The following two excerpts may help to illustrate these concerns:

> Accountability systems and incentive structures, no matter how well designed, are only as effective as the capacity of the organization to respond. The purpose of an accountability system is to focus the resources and capacities of an organization towards a particular end. Accountability systems can't mobilize resources that schools don't have … the capacity to improve precedes and shapes schools' responses to the external demands of accountability systems (Elmore 2004b:117).

> If policy-makers rely on incentives for improving either a school or a student, then the question arises, incentives to do what? What exactly should educators in failing schools do tomorrow – that they do not do today – to produce more learning? What should a failing student do tomorrow that he or she is not doing today? For both parties, perhaps it is as simple as trying harder, a behavioural change ripe for incentives to influence. If the solution is not that simple, however, trying harder will lead to marginal gains. Greater gains will materialize only for those who know what to do. There will be students and teachers who try hard and fail – and they will be penalized for their failures. The spectre of that entails political risks… At the classroom level, even teachers who have been motivated to change by accountability must know what to do differently to convert struggling learners into accomplished ones… It is difficult to sanction someone for an unacceptable outcome – and, in democratically governed institutions, to justify the sanctioning as fair – when no one can describe, with reliability and precision, how to produce an acceptable outcome (Loveless 2005:16, 26).

Similarly, simply providing principals and teachers with ANA results is unlikely to yield considerable improvement if the cause of low performance is not primarily effort-related (attendance, time-use and motivation) but, rather, is linked to the lack of core competencies of the staff. While the South African literature suggests that there are serious effort-related problems, and that those problems may well be amenable to incentives and a bureaucratic form of accountability, the gains from improving teacher attendance are likely to be modest if the binding constraint is teacher content knowledge, for example. As Elmore (2002, in Shalem 2003:41) notes:

> Giving test results to an incoherent, atomized, badly run school doesn't automatically make it a better school. The ability of a school to make improvements has to do with the beliefs, norms, expectations, and practices that people in the organization share, not with the kind of information they receive about their performance. Low-performing schools aren't coherent enough to respond to external demands for accountability …. Low-performing schools, and the people who work in them, don't know what to do. If they did, they would be doing it already. You can't improve a school's performance, or the performance of any teacher or

> student in it, without increasing the investment in teachers' knowledge, pedagogical skills, and the understanding of students. This work can be influenced by an external accountability system, but it cannot be done by that system.

Elmore explains that systems need a 'theory of improvement', which is essentially what is required to answer Loveless's (2005:16) question: 'What exactly should educators in failing schools do tomorrow – that they do not do today – to produce more learning?' Elmore (2004a:21) explains what he means by a theory of improvement as follows:

> In order for an accountability system to be based on improvement, it has to embody an underlying theory of how schools improve their performance. Simply constructing an incentive structure of standards and testing around the expectation of steady improvements in performance is not a theory of improvement. A theory of improvement actually has to account for how people in schools learn what they need to know in order to meet the expectations of the accountability system.

Unfortunately, in South Africa such a theory of change – an explication of what principals and teachers need to do to improve – is sorely lacking. Developing such a theory of change requires both hypothesising theoretical ideas of how change occurs, but also in empirically testing those hypotheses by implementing them on a small scale. After an evaluation of the intervention, the researcher can use the results to modify their theory of change. One of the leitmotifs running through much of the South African education discourse at the moment is the central importance of monitoring and evaluating interventions. Unless interventions are evaluated in rigorous ways that can identify the causal impact (or lack of impact) of an intervention, policy-makers and practitioners are left with little information on which to base their decisions. Which programmes work? How large is the impact? What is the cost per student or teacher? All these questions can only be answered after a rigorous independent evaluation. Although there are currently hundreds of educational interventions currently being implemented across the country, an exceedingly small number of them (<10%) have been (or are being) rigorously evaluated by an independent evaluator.

This is especially the case for mathematics teachers with weak content knowledge and the interventions associated with this problem. What exactly should primary school mathematics teachers do if they are themselves not competent in the curriculum that they are teaching (despite having an 'appropriate' qualification)? This is surely one of the motivations behind Shalem's (2003:29) caution on the topic of performance-based accountability in South Africa: 'until we are sure that we have given our teachers meaningful learning opportunities, the belief in performance-based accountability remains highly problematic'. The example of weak mathematics teacher content knowledge in South Africa is a case in point, highlighting the prerequisite of capacitation for any accountability system.

Mathematics teacher content knowledge in South Africa

Perhaps the best example of a capacity constraint preventing progress is the low content knowledge levels of mathematics teachers in South Africa. Teacher mastery of subject matter is essential to curriculum implementation and, at its most basic level, teachers cannot teach what they do not know. In its comprehensive report, *The mathematical education of teachers*, the Conference Board of Mathematics Sciences (CBMS 2001) recommends that mathematics teachers need 'a thorough mastery of the mathematics in several grades beyond that which they expect to teach, as well as of the mathematics in earlier grades'. Yet, the literature on the content knowledge of South African teachers reveals that many have not mastered the curricula they are expected to teach (for example, see Taylor & Moyane 2004; Fleisch 2008; Spaull, 2013). Taylor and Vinjevold's (1999:230) conclusion in their book, *Getting learning right*, is particularly explicit:

> The most definite point of convergence across the [President's Education Initiative] studies is the conclusion that teachers' poor conceptual knowledge of the subjects they are teaching is a fundamental constraint on the quality of teaching and learning activities, and consequently on the quality of learning outcomes.

More recently, Carnoy *et al.* (2011) found that Grade 6 mathematics teachers in the North West achieved an average score of 40 per cent on a test consisting primarily of Grade 6-level items (see also Taylor & Reddi 2013; Taylor & Taylor 2013). While most previous studies of mathematics teacher content knowledge in South Africa have been local, isolated, project-based inquiries, the SACMEQ 2007 survey tested a nationally representative sample of students and their teachers (Moloi & Chetty 2011). SACMEQ 2007 South Africa tested 9083 Grade 6 students from 392 schools sampled to be nationally representative of the Grade 6 student population. Of the 498 Grade 6 mathematics teachers from the 392 schools, 401 teachers wrote the mathematics teacher test, providing valuable information on the mathematics content knowledge of South African teachers. While SACMEQ 2000 also contained a teacher test, South African teachers did not write it in 2000, due to union objections at the time.

In the international SACMEQ report, *Levels and trends in school resources among SACMEQ school systems*, Hungi *et al.*(2011) report that only 32 per cent of South African Grade 6 mathematics teachers have desirable levels of mathematics content knowledge. This is in stark contrast to many other poorer African countries with much higher proportions of maths teachers with desirable levels of mathematics content knowledge; for example, Kenya (90 per cent), Zimbabwe (76 per cent) and Swaziland (55 per cent). The situation is also highly variable by province in South Africa with Mpumalanga having almost no Grade 6 maths teachers with desirable content knowledge (4 per cent). The figure for the Eastern Cape is 17 per cent, for Gauteng it is 41 per cent and for the Western Cape it is 64 per cent.

One of the most common methods of reporting the results of the SACMEQ teacher test is to tabulate the average standardised mathematics score for different subgroups (see, for example, Moloi & Chetty 2011). However, knowing that the South African average Grade 6 mathematics teacher test score is 764 is not particularly illuminating since these scores cannot be interpreted intuitively. While they may be useful for comparing the *relative* performance of provinces (for example, the average score in the Western Cape was 852, while in Mpumalanga it was 700), it is difficult to discern the *absolute* or level of performance using this measure. One way to report the level of performance of South African teachers in an intuitive way is to consider examples of test items as well as the achievement levels of South African Grade 6 maths teachers on those items. For a full discussion of mathematics teacher content knowledge in South Africa, se Venkat and Spaull (2015).

In addition to the performance of South African teachers on these items, we can also calculate the performance of Grade 6 mathematics teachers from other African countries as well as of students from wealthier countries around the world. This is because the SACMEQ mathematics tests developed for teachers and students included overlapping items from earlier studies, including the TIMSS of 1995 (see TIMSS 1997; Ross *et al*. 2005). This makes it possible to compare the performance (on the same items) of Grade 6 mathematics teachers from SACMEQ countries with Grade 8 students from the 38 countries that participated in the TIMSS Grade 8 study in 1995. Of the 42 questions asked in the SACMEQ mathematics teachers' test, 16 are taken from the 1995 TIMSS Grade 8 test.[4] To provide an indication of the type of questions asked and the levels and distribution of underperformance, an example item (Question 35) from the test is shown:

4 In the SACMEQ III (2007) mathematics teachers test, the 16 items and corresponding TIMSS 1995 Grade 8 items (in brackets) are as follows: tmath04 (R-12); tmath09 (P-08); tmath18 (I-08); tmath19 (J-14); tmath20 (J-18); tmath21 (K-04); tmath23 (K-06); tmath24 (L-11); tmath25 (K-08); tmath26 (L-14); tamth27 (L-17); tmath28 (M-06); tmath30 (Q-01) tmath31 (R-07); tmath32 (R-09); tmath35 (V-03). For further information, see Ross *et al*. (2005) and, given that all 16 items have now been released, they can be found at IEA (1997). One important proviso is that in the SACMEQ 2007 tests there were four multiple choice options, while in the TIMSS 1995 tests there were five options. Thus, while TIMSS 1995 Grade 8 students and SACMEQ 2007 Grade 6 teachers were given the same 16 questions, in the TIMSS test there was one additional possible answer. This could lead to an overestimate of SACMEQ teachers' achievement relative to TIMSS students because the rate of successful guessing will be higher in SACMEQ than in TIMSS. It is worth noting that all the SACMEQ items analysed and included in this paper are in the public domain since they constitute part of the released items from the TIMSS 1995 study.

35. To mix a certain colour of paint, Enni combines 5 litres of red paint, 2 litres of blue paint, and 2 litres of yellow paint. What is the ratio of red paint to the total amount of paint?

A. ☐ 5 : 2
B. ☐ 5 : 4
C. ☐ 5 : 9
D. ☐ 9 : 4

Student or teacher	Country	Question 35 (percentage correct)
Grade 6 mathematics teachers (SACMEQ 2007)	South African average	33%
	SA Quintile 1	28%
	SA Quintile 5	54%
	Kenya	82%
	Botswana	52%
	Tanzania	53%
Grade 8 students (TIMSS 1995)	South Africa	16%
	Singapore	95%
	Korea	87%

This question reveals just how low South African Grade 6 mathematics teachers' content knowledge really is. It is well within the Grade 6 maths curriculum, yet only 33 per cent of the South African Grade 6 maths teachers could answer it correctly. This is only marginally above what teachers would get if they just guessed the answer, since they would get it right 25 per cent of the time on a four-choice test item. In contrast, 82 per cent of Kenyan Grade 6 maths teachers and 53 per cent of Tanzanian Grade 6 maths teachers could answer it correctly. Looking at the performance of Grade 8 TIMSS (1995), students on this same item shows that while an astonishingly low 16 per cent of South African Grade 8 students could answer this question correctly, 87 per cent of Korean Grade 8 students and 95 per cent of Singaporean Grade 8 students could answer it correctly (TIMSS 1997). In other words, the average 14-year-old in Singapore or Korea would perform better on this item than the average Grade 6 maths teacher in South Africa. In fact, of the 16 questions that were common to both the Grade 6 maths teacher test (SACMEQ 2007) and the Grade 8 student test (TIMSS 1995), South African teachers scored

only 30 per cent correct after adjusting for guessing.[5] The figure for Kenyan Grade 6 maths teachers is 72 per cent, and for Singaporean Grade 8 students it is 71 per cent (both also adjusted for guessing). Four additional example items (from the released items) are provided in Appendix 3.1, together with a table reporting the average percentage of correct answers for each of those items after correcting for guessing.

Given that the evidence base is large, consistent and unambiguous, Taylor and Reddi (2013:228) are correct in concluding that 'the subject knowledge base of the majority of South African Grade 6 mathematics teachers is simply inadequate to provide learners with a principled understanding of the discipline'. Most recently, Venkat & Spaull (2015:121) quantify this by using the SACMEQ 2007 data and find that '79% of grade 6 mathematics teachers showed content knowledge levels below the grade 6/7 level band'. Such a situation epitomises a lack of capacity. As Elmore (2004a:117) observes, 'accountability systems can't mobilize resources that schools don't have'. This is not to say that incentives cannot improve student outcomes by changing teacher behaviour. Various outcomes are achievable through the use of tangible sanctions and rewards (incentives) that encourage changes in behaviour – for example, increasing the amount of pressure on teachers to get to school on time, to teach for the full duration of the day and to decrease unwarranted teacher absenteeism. All of these are effort-related deficiencies and the teacher action required (the theory of change) is clear – to be in school, on time, teaching. Creating an accountability system to monitor teacher attendance is an administrative problem with an identifiable solution. However, it is less clear what incentives could effectively raise teacher content knowledge. To paraphrase Loveless (2005), what exactly should weak mathematics teachers do tomorrow – that they do not do today – to raise their content knowledge? In South Africa, no teacher-training programme has been piloted, implemented at scale, evaluated and proven to raise mathematics teacher content knowledge. It is one of the scandals of higher education in South Africa that 20 years into democracy we still cannot point to a single programme (or set of programmes) that has been proven to raise mathematics teacher content knowledge at scale (see Venkat & Spaull 2015). In some instances, there are small, localised training programmes – often run by NGOs – offering in-service teacher training. However, there is no 'teacher curriculum' that outlines what different teachers need to know for each phase in order to teach the subjects they are teaching. There is no standardised teacher-board-exam that tests new teachers to see if they have the knowledge and skills necessary to teach students in their particular subject or phase. Rather, it is assumed that teachers qualifying with a Bachelor of Education degree automatically possess the requisite knowledge and skills, which may not be true.

In sum, while traditional accountability mechanisms and incentives may be effective in decreasing teacher absenteeism and increasing teaching time, they are

5 See Frary (1988) for the formula used to adjust for guessing.

unlikely to raise teacher content knowledge. Increasing pressure on teachers who lack mathematics content knowledge, and know of no way to improve it, is unhelpful and likely to lead to teachers subverting the aims of the accountability system rather than working towards those aims.

CAPACITY WITHOUT ACCOUNTABILITY

One of the major insights from the discipline of economics is the importance of incentives. Without something to motivate actors to use the resources available to them, it is difficult to overcome the inertia of existing behaviour. While the previous section argues that accountability systems cannot mobilise resources that schools do not have, this section argues that without an accountability system additional resources will not be 'mobilised'. Taylor (2002:17) provides a compelling argument that training initiatives should be aligned with the accountability mechanisms in the system:

> In the absence of accountability sub-systems, support measures are very much a hit and miss affair. Accountability measures provide motivation for and direction to support measures, by identifying capacity shortcomings, establishing outcome targets, and setting in place incentives and sanctions which motivate and constrain teachers and managers throughout the system to apply the lessons learned on training courses in their daily work practices. Without these, support measures are like trying to push a piece of string: with the best will in the world, it has nowhere to go. Conversely, the performance gains achieved by accountability measures, however efficiently implemented, will reach a ceiling when the lack of leadership and technical skills on the part of managers, and curricular knowledge on the part of teachers, places a limit on improved performance. Thus, the third step in improving the quality of schooling is to provide targeted training programs to managers and teachers. To achieve optimal effects, these will need to connect up with and be steered by accountability measures.

This is in agreement with Shalem (2003), who argues that more conceptual work is needed regarding the alignment between pressure and support in South Africa. This notion of alignment between accountability and capacity (or pressure and support in Shalem's terms) is an important one, which deserves further discussion.

ALIGNMENT BETWEEN ACCOUNTABILITY (INCENTIVES/PRESSURE) AND CAPACITY(SUPPORT)

As mentioned above, much of the 'new accountability' literature focuses on the interplay between capacity and support. Figure 3.1 provides a graphical overview of the two scenarios discussed above, as well as integrating the issue of alignment between pressure and support. The size of each circle corresponds to the amount of accountability or capacity, with a larger circle representing more accountability or

more support. The overlap of the two circles corresponds to the extent to which the accountability mechanisms and the support mechanisms are aligned – the greater the overlap, the better the alignment. These overlapping sections are labelled 'improvement' since, it is argued, only when schools have both the incentive to respond to an accountability system and the capacity to do so will there be an improvement.

In the 'Status quo' quadrant there are two circles representing accountability (on the left) and capacity (on the right) with some overlap (alignment). These correspond to the existing levels of accountability, capacity and alignment in the system at the moment. If one improves only the amount of capacity and support in the system (a move to 'Scenario 1'), without an improvement in accountability or alignment, the size of improvement (the area of the overlap) does not change by very much. Similarly, if one increases only accountability and incentives, without an improvement in capacity and support (a move to 'Scenario 2'), the size of the improvement (the area of the overlap) remains much the same. Scenario 1 here refers to the problem of capacity without accountability, while Scenario 2 refers to the problem of accountability without capacity. These are essentially the areas of no overlap between the two circles. The area of the accountability circle where there is no overlap corresponds to the situation where teachers cannot respond to the incentives of the accountability system because they do not have the knowledge or skills to do so. In contrast, the area of the capacity circle where there is no overlap corresponds to the situation where teachers have no incentive to deploy the knowledge and skills that they already possess in the task of improving student outcomes.

There are obviously several other scenarios, and Figure 3.1 is intended to illustrate a conceptual point rather than to posit an empirical or general theory of accountability and support. One such scenario is where there is no increase in either accountability or support, but rather an improvement in alignment (overlap) between the two circles. By better aligning the incentives of teachers with what they are currently capable of achieving, it is also possible to increase the amount of improvement in the system.

HOW TO IMPROVE EDUCATIONAL OUTCOMES BY INCREASING ACCOUNTABILITY

Binding constraints to progress

The above discussion focuses primarily on the broad ideas of accountability and capacity. However, these are overarching, catch-all concepts that can be difficult to operationalise. The broad notion of capacity includes the content knowledge of eachers, the administrative capacity of principals, the logistical capacity of district officials and so on. While there may be deficits in any of these areas, it is highly

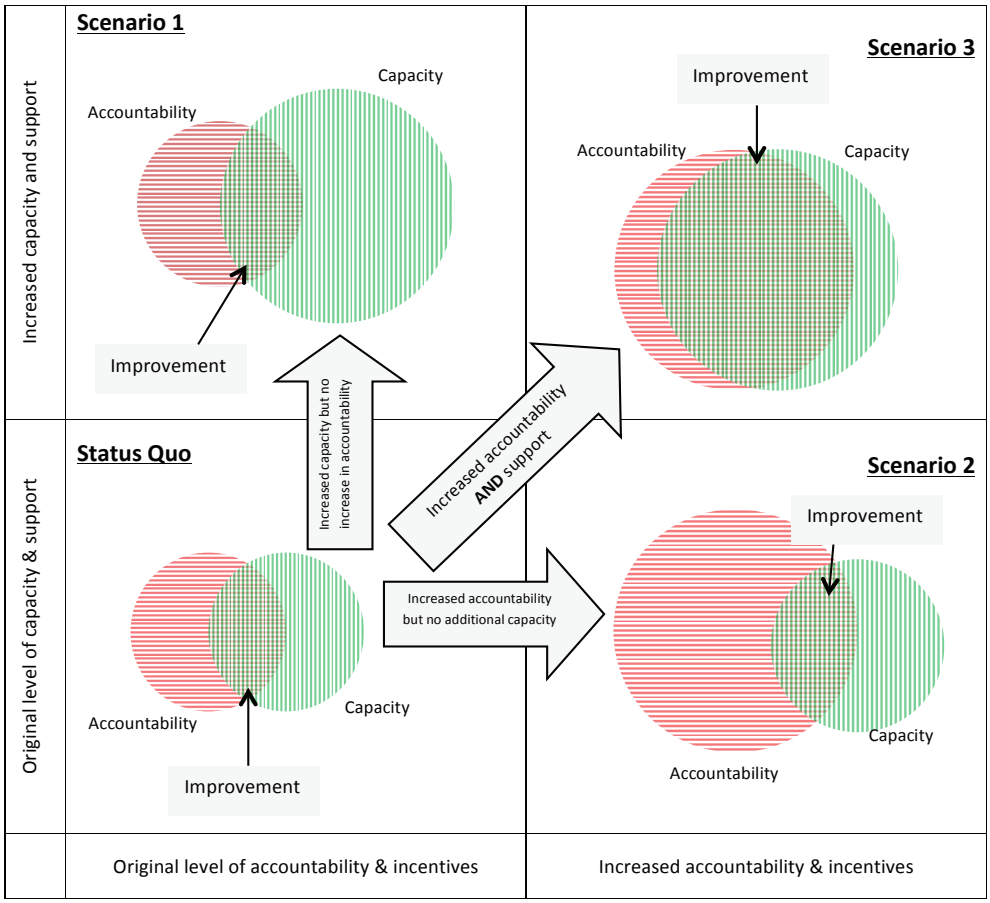


Figure 3.1: The alignment between accountability/incentives and capacity/support

tunlikely that each of these constraints binds equally. In other words, some capacity constraints are more binding than others. Similarly, the broad notion of accountability includes the systems that prevent unwarranted teacher absenteeism, monitor textbook delivery, ensure parents are well informed about the performance of their children, and so on. While there are certainly deficits in each of these areas, it is also highly unlikely that the lack of accountability in each area is equally detrimental. Should policy-makers aim to improve mathematics teacher content knowledge, or introduce biometric teacher attendance-monitoring devices, or externally evaluate the ANAs and provide parents with information on their children's learning? While all of these and other issues are important, a 'do-everything' approach will be ineffective due to limited physical and human resources. When faced with a plethora of problems (both

capacity constraints and accountability deficits) and limited resources, prioritisation is essential.

The binding constraints approach of Hausmann, Klinger and Wagner (2008) is helpful here. This method is based on the idea that not all constraints bind equally and, therefore, that the most sensible strategy is to identify the most serious constraints at work – the binding constraints (Rodrik 2009).

Hausmann *et al*. (2008) provide a helpful illustration of the conceptual difference between a binding constraints approach and an all-constraints-bind-equally approach. Figure 3.2 adapts their illustrateive example and applies it to the case of education in South Africa. As they explain:

> The left hand barrel has horizontal wooden slabs, while the right hand side barrel has vertical slabs. The volume in the first barrel depends on the sum of the width of all slabs. Increasing the width of any slab will increase the volume of the barrel. So a strategy on improving anything you can, when you can, while you can, would be effective. The volume in the second barrel is determined by the length of the shortest slab. Two implications of the second barrel are that the impact of a change in a slab on the volume of the barrel depends on whether it is the binding constraint or not. If not, the impact is zero. If it is the binding constraint, the impact will depend on the distance between the shortest slab and the next shortest slab (Hausmann *et al*. 2008:17).

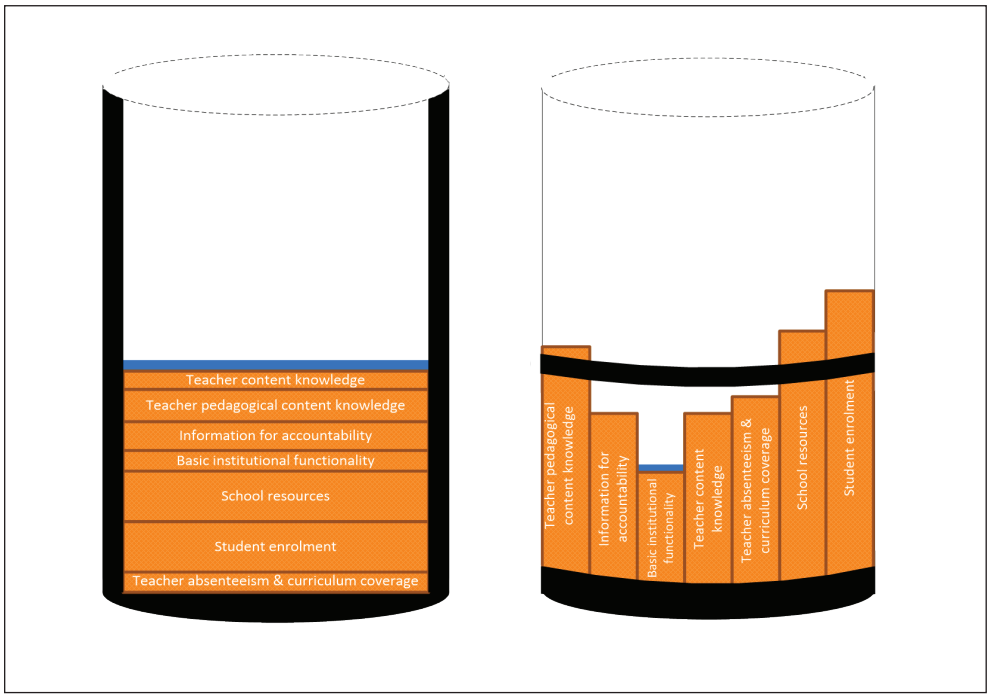


Figure 3.2: How much liquid will the barrel hold? (hypothetical example)

The heights of the various slabs in the hypothetical example presented in Figure 2.3 provide an example of how addressing one constraint may not be effective if it is not the binding constraint. Implementing measures to improve curriculum coverage may not help very much if teachers lack the content knowledge to teach those additional areas of the curriculum. In reality, the situation is likely to be neither the left-hand-side barrel nor the right-hand-side barrel but some combination of the two, as Hausmann *et al*. (2008) themselves note. Using the above example, increasing teacher content knowledge in the absence of basic institutional functionality is likely to have some effect, even though it is not the shortest slab in the diagram and technically the barrel would not be able to hold more water. However, that effect is reduced by the lack of basic institutional functionality (the binding constraint in the example).

In the example, 'basic institutional functionality' is listed as the binding constraint (the shortest slab). The reason for this is that unless schools can manage the school day and ensure that teachers and students are at school and in class teaching and learning, no amount of capacitation will improve results. If a school is a completely dysfunctional unit, teacher training initiatives or additional resources are unlikely to yield gains. The 2012 NEEDU report comes to a similar conclusion: 'The school improvement research literature is unequivocal that institutional functionality must be fixed before capacitation strategies can "take". This is partly why INSET [in-

service teacher training] initiatives have delivered such disappointing results so far' (NEEDU 2013:72).

The constraints in Figure 3.2 are only a selection of the full range of constraints in the South African education system, and the relative heights of the slabs (i.e., the degree to which each constraint is binding or not) is subjective. While different researchers may allocate different weights to different constraints, the final set of constraints and relative heights should ultimately be determined in consultation with a range of experts and the research community at large. The reason why this way of thinking is helpful is that it makes the prioritisation process explicit. When faced with limited human and physical resources and a large number of constraints – such that one cannot realistically solve all problems simultaneously – one is forced to choose which problems to solve first. This is not possible without an evidence-based hierarchy of problems, which can then be used to garner consensus among various interest groups as to which problems need to be addressed in what order (in other words, which can be delayed legitimately). Without prioritisation, resources are spread too thin and there is no meaningful progress.

The central importance of the Annual National Assessments

It is now generally accepted that the widespread implementation of the Annual National Assessments (ANAs) in 2011 was an important milestone on the road to improving educational quality in South Africa. Until this point, the only standardised national exams that existed were at the exit level of the schooling system (matric). All other exams were either provincial (Systemic Evaluations in the Western Cape), limited to a nationally representative sample (Systemic Evaluations, TIMSS, PIRLS, SACMEQ) or, more commonly, decided at the school or classroom level. Without a nationally comparable (standardised) exam at the primary school level, one could not compare schools across provinces or districts, or over time. Consequently, it was not possible for policy-makers or parents to determine if a primary school was underperforming, at least not with any measure of certainty. This absence of any externally evaluated, standardised exam at the pre-matric level led to a number of serious problems. Due to a lack of information and a lack of capacity to deal with the problems, many schools promoted students to higher grades with little regard for whether or not the children had acquired the knowledge and skills necessary for those grades. This has led to a situation where there is little drop-out before Grade 11, but up to 50 per cent of the cohort dropping out between Grade 10 and Grade 12 as students approached the externally evaluated matriculation exam (Grade 12). As Van der Berg *et al*. (2011: 4) explain, 'low quality education combined with high and lenient grade progression up until Grade 11 means when a standardized assessment occurs, i.e. the Matric examination, this serves to filter a large proportion of weak students out of further attainment'. It would be wrong to look at the high

drop-out rate in Grade 11 and conclude that the problem lies primarily in Grade 10 and 11, or even in high school. Although it is likely that there are problems in these grades as well, much research shows that South African students do not acquire the foundational skills in primary school that are needed to succeed in high school (Spaull & Kotze 2015). Every single international assessment shows that the majority of South African primary school children do not acquire the basic skills of the grade they are in or of previous grades (see, for example, Fleisch 2008; Moloi & Chetty 2011; Taylor *et al*. 2013).

Given that the research shows that most South African students are incurring learning deficits early on in their academic careers, it is only logical that the focus of government intervention should be on the primary school years (Spaull 2013). However, without an accurate indication of the levels and trends of school performance, support cannot be targeted where it is needed most. The same is true for principals providing targeted support to individual teachers, and teachers to individual students. This points to the fundamental importance of the ANAs; if implemented properly, they can provide reliable information on learning outcomes at the primary grades. Unfortunately, the ANAs have not been implemented properly to date.

Various concerns have been raised by numerous academics, including those on the ANA advisory committee, such as Surette van Staden, who refers to the reported improvements between 2011 and 2012 as 'highly unlikely' (John 2012). Mary Metcalfe, former higher education director-general, reiterates this point when she cautions that 'we need to be sceptical of these results' (John 2012). Vishnu Naidoo, the chairman of the Foundation for English, Mathematics, Science and Innovation of South Africa (FEMSISA) – the body that runs the national mathematics Olympiads – has voiced concern regarding the credibility of the ANA Grade 9 mathematics paper, referring to the test as 'an absolute disaster' (Naidoo 2012). Van der Berg and Spaull (2012) stress that many of the reported 'improvements' between ANA 2011 and ANA 2012 are exceedingly improbable, if not impossible. For example, the average Grade 3 literacy score improved from 35 per cent in 2011 to 52 per cent in 2012 (a 49 per cent increase), which would make South Africa the fastest improving country in the history of standardised assessments around the world – improving more in a year than the fastest improving countries did in seven years (Spaull 2013). More plausibly, the 2011 and 2012 tests are not legitimately comparable. The 2012 NEEDU report captures these concerns as follows:

> There are many factors which raise questions about the validity and reliability of the ANA results, rendering comparisons between schools on the same test, or within the same school or unit of the system over time, prone to significant margins of error. These include

> psychometric comparability of successive question papers, the fidelity of administration, scoring and collating procedures (NEEDU 2013:55).

While the implementation of the ANAs should be praised for beginning to rectify one of the major deficiencies in the South African education system, the above concerns require increased attention from ANA implementers. For the ANAs to fulfil their role as a means of targeting support and holding schools accountable, they must be a valid and reliable indication of student learning. This has implications for curriculum alignment, psychometric validity and external evaluation. The ANAs should be externally evaluated and marked by an independent body (like Umalusi, the matric certification body) for at least one grade per year – perhaps Grade 3 and Grade 6. Although this will require considerable resources, implementing a reliable system of testing and support at the primary level is arguably one of the greatest needs in the South African system. Without such an externally evaluated and independently administered test, much of the value of the ANAs is eroded, and can actually do harm. Providing schools with inaccurate (or simply incorrect) measures of performance means that schools, teachers and parents are receiving erroneous feedback. For example, the reported improvements between ANA 2011 and 2012 create the impression of a remarkable improvement in school performance, which did not really occur. This makes it so much more difficult to promote improvement in behaviour at the classroom level, and that is central to real advances in learning outcomes.

Balancing the rights and concerns of children and teachers

From an ethical and public policy perspective, it is important to remember that one cannot focus on the rights and concerns of children to the exclusion of those of teachers, but neither can one focus on the rights and concerns of teachers to the exclusion of those of children. Rather, one has to find a balance between the rights and concerns of both parties. Much of the economic literature discussed above foregrounds the rights of children – primarily the right to acquire the knowledge, skills and values needed to be full members of society (i.e., the right to a quality education). In contrast, many of the objections to accountability reforms made by educationists are on the grounds that these reforms demean teachers and undermine their professionalism and dignity. In a democratic society, one has to find an equitable equilibrium by weighing up the relative concerns of all interest groups. This is especially the case when the concerns of one party (for example, parents) may diverge from the concerns of another (for example, teacher unions). Let us take an illustrative example of releasing the ANA results to parents. Given the concerns around the reliability and validity of the ANA results, there are serious technical matters that have to be addressed before one could consider releasing ANA results to parents. Even if we assume that in the next three years the DBE will provide additional resources to Umalusi to externally evaluate

the ANAs in Grade 3 and Grade 6 across the country, such that we have reliable estimates of student learning for those grades, the question remains as to whether or not those results should be provided to parents, and in what format.

Clearly parents have a right to know what their children are learning. This right is independent of the resources or capacity constraints of the school or the teachers at the school. Whether or not the teachers in a particular school have received adequate training and support is immaterial to the right of parents to know whether or not their children are learning anything. While it is true that it is unfair to hold teachers accountable for something they cannot do (for example, if they do not have the content knowledge to teach certain content areas), it is equally unfair, if not more unfair, to deprive parents of performance information on the basis that teachers do not currently have the capacity to respond to external pressures. One could think of a similar scenario in the health-care sector, where it would be unthinkable to withhold a medical diagnosis from a patient because a particular hospital does not have the skills or resources to treat a particular problem.

With respect to the ANAs, the debate in South Africa is less about whether or not results should be released to parents than about what format those results should take. Should report cards only indicate the absolute performance of a particular child and the particular school (this is the current departmental policy), or should there be an element of comparative performance, indicating where that school is in relation to other socio-economically comparable schools in the district, province or country? The latter is likely to place increased pressure on school principals and teachers, as parents either move their children to better performing schools, or demand explanations for why their Grade 4 child cannot read, for example. Often, the interests of parents and teachers are portrayed as being aligned – everyone wants quality education – however, there are several scenarios where the interests of these two groups seem to diverge. In these situations, the political power of each group comes into play. Almost all teachers in South Africa belong to organised and politically powerful teacher unions, enabling them to speak with one voice and command considerable political influence. The interests of teachers are well represented in the South African polity. In contrast, parents are often atomised and find no coherent body through which they can express their educational interests as parents, except for the normal political process of voting every five years. Parents of primary school children lack reliable information on the performance of their children relative to normal benchmarks (like being able to read by 8 years of age), or relative to socio-economically similar schools in the region. As it stands, parents have to use proxies for primary school performance, such as the levels of order and discipline in the school, or the appearance of the school, all of which are only very loose indicators of performance.

Given the reality of politically organised and empowered teacher unions and politically disorganised and disempowered parents, any situation where there is a

conflict of interests between parents and teachers should be carefully considered. Furthermore, for obvious reasons, children do not have direct political representation (as teachers do), but, rather, are 'spoken for' by parents or care-givers (where these exist). This is especially important to remember when one considers that there are roughly 12 million children of school-going age and only around 400 000 educators in South Africa.

CONCLUSION

After even a cursory glance at the data on South African education, no one would argue that we have too much accountability in the South African education system. The schooling system in the country is characterised by high rates of teacher absenteeism, low rates of curriculum coverage and an exceedingly weak correlation between increased expenditures and improved education outcomes. Most disconcertingly, these problems are most prevalent in the poorest schools where capacity constraints are greatest and accountability mechanisms weakest. Although these problems are most acute in poor schools, low levels of accountability permeate all levels of the system, from the national department down to the classroom, revealing a lack of bureaucratic accountability as well as a lack of professional accountability among teachers. At all levels of the system there are essentially no tangible consequences for non-performance.

In searching for a way forward, this article outlines two dead-end possibilities – increasing accountability without increasing support, and increasing support without increasing accountability. Both scenarios fail to improve performance because, in the case of the former, schools cannot mobilise resources they do not have and, in the latter, teachers have no incentive to mobilise themselves or the resources at their disposal. This highlights the importance of aligning the structures of accountability with the processes of capacitation. Only when schools have both the incentive to respond to an accountability system and the capacity to do so will there be an improvement in student outcomes. On a practical level, until such a time when we have a large number of interventions that have been rigorously evaluated – both capacity-building and accountability-enhancing interventions – we will not have the evidence base needed for sound resource allocation, which is itself a prerequisite for improved quality of education for all, especially the poor.

After discussing the theoretical concepts of accountability, support and alignment, the latter half of the article focused on three issues central to the policy-making process: prioritisation, measurement and balancing the concerns of constituencies. When faced with limited resources, prioritisation is inevitable (and desirable). By creating an evidence-based hierarchy of constraints, it becomes possible to identify the binding constraints to progress and to target existing financial and human resources towards solving those problems first. Secondly, it is argued that without a reliable indicator of student learning at the primary school level, it is not possible to improve outcomes. While the ANAs are a clear move in the right direction, their

current implementation negates much of their value. Lastly, the article cautions against prioritising the concerns of a politically organised minority (teacher unions) over those of a politically atomised majority (parents and children).

Moving forward, teachers should be provided with meaningful learning opportunities to improve their skills, and parents should be empowered with accurate information on their children's learning relative to appropriate benchmarks and the performance of socio-economically similar schools. The latter should not be contingent on the former. Without accurate information on their children's learning, parents cannot put pressure on schools or express their concerns through appropriate political channels.

The wholesale lack of accountability for student learning outcomes in South Africa is arguably one of the major impediments to quality education for the poor. The substandard education offered to the poor in South Africa does not develop their capabilities or expand their economic opportunities; it does not teach the critical thinking skills necessary for either true democratic participation or to challenge unjust structures of society. Instead, it denies them dignified employment and undermines their sense of self-worth. Most importantly, these students will struggle to become full members of society or critical participants in their polity. Until there is an increase in both accountability and capacity, there is little reason to believe that there should be any measurable improvement in student learning outcomes in South Africa.

Appendix 3.1: Examples from the SACMEQ 2007 teacher test and the TIMSS 1995 Grade 8 student test (all of which are released items).

21. $\frac{x}{2} < 7$ is equivalent to…

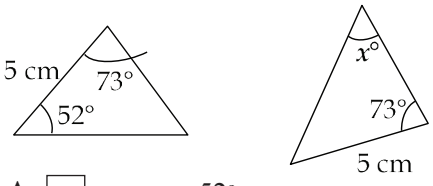
A. ☐ $x > 14$

B. ☐ $x < 14$

C. ☐ $x > 5$

D. ☐ $x < \frac{7}{2}$

25. These triangles are congruent. The measures of some of the sides and angles of the triangles are shown. What is the value of x?



A. ☐ 52°

B. ☐ 55°

C. ☐ 65°

D. ☐ 75°

27. What is the value of: $\frac{2}{3} - \frac{1}{4} - \frac{1}{12}$?

A. ☐ $\frac{1}{6}$

B. ☐ $\frac{1}{3}$

C. ☐ $\frac{3}{8}$

D. ☐ $\frac{5}{12}$

31. A stack of 200 identical sheets of paper is 2,5 cm thick. What is the thickness of one sheet of paper?

A. ☐ 0,008 cm

B. ☐ 0,0125 cm

C. ☐ 0,05 cm

D. ☐ 0,08 cm

Examples of performance on specific questions

	SACMEQ 2007 Maths teacher test item name	Question 21	Question 25	Question 27	Question 31	Question 35	Average of 16 questions (uncorrected for guessing)	Average of 16 questions (corrected for guessing)
	TIMSS 1995 item name	**TIMSS k4**	**TIMSS k8**	**TIMSS l17**	**TIMSS r7**	**TIMSS v3**		
Grade 6 Maths Teachers (SACMEQ 2007)	South Africa	50%	44%	62%	47%	33%	47%	30%
	Botswana	46%	62%	77%	44%	52%	56%	41%
	SACMEQ average	55%	53%	74%	54%	53%	56%	41%
	Swaziland	51%	68%	81%	62%	48%	63%	50%
	Uganda	75%	49%	82%	62%	84%	64%	52%
	Tanzania	65%	62%	85%	76%	53%	64%	53%
	Kenya	74%	66%	88%	73%	82%	72%	63%
	Eastern Cape	44%	40%	56%	46%	18%	39%	19%
	Free State	56%	56%	67%	53%	41%	55%	40%
	Gauteng	59%	41%	67%	41%	37%	46%	28%
	KwaZulu-Natal	50%	42%	61%	50%	44%	51%	34%
	Limpopo	60%	49%	67%	54%	31%	50%	33%
	Mpumalanga	38%	33%	50%	28%	21%	40%	20%
	Northern Cape	60%	51%	65%	54%	28%	52%	37%
	North West Province	38%	48%	53%	56%	33%	46%	28%
	Western Cape	42%	58%	69%	57%	38%	55%	40%
	SA Quintile 1	45%	40%	60%	47%	28%	45%	26%
	SA Quintile 2	51%	35%	66%	45%	30%	45%	27%
	SA Quintile 3	40%	43%	50%	37%	19%	42%	22%
	SA Quintile 4	51%	54%	54%	42%	35%	48%	31%
	SA Quintile 5	64%	49%	77%	66%	54%	58%	44%
	South Africa	50%	44%	62%	47%	33%	47%	30%
Grade 8 students (TIMSS 1995)	South Africa	22%	14%	20%	35%	16%	24%	6%
	TIMSS Gr8 average	44%	35%	51%	48%	41%	45%	31%
	Switzerland	39%	33%	62%	59%	42%	48%	35%
	Netherlands	49%	21%	51%	54%	65%	48%	35%
	Austria	52%	29%	60%	61%	21%	50%	37%
	France	42%	50%	67%	64%	51%	53%	41%
	Hong Kong	61%	61%	78%	73%	70%	62%	52%
	Korea	67%	66%	78%	66%	87%	63%	53%
	Singapore	69%	69%	93%	71%	95%	71%	63%

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