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# WHAT ARE BACKLOGS?

Unavoidably defined in terms of the content and assessment standards of the national curriculum.

Prescribes a cumulative and hierarchical sequence of skills and competencies for each grade level in which a minimum level of mastery of the content of each grade is required in order to deal with and grasp the content of the succeeding grade.

Learners with an inadequate grasp of the content of the previous grades but who are, nonetheless, progressed to the next grade level are necessarily limited in their ability to deal with and benefit from instruction in this grade. The process is cumulative and self-sustaining and the difference between the expected and actually attained minimum levels of competence tends to widen from one grade to the next - unless some form of effective remediation is successfully applied.

It is this difference between what learners are expected to know, and what they actually do know, that we refer to as a content backlog.

# BACKLOGS IN MATHEMATICAL EDUCATION ARE AN ENDURING AND SIGNIFICANT PHENOMENON ACROSS THE EDUCATION SYSTEM THAT HAVE PERSISTED FOR OVER TWO DECADES

Poor outcomes in mathematical education have proved to be a persistent, even endemic, feature of the South African education system. Large gaps between the minimum expected and actually attained levels of learner performance were first noted systematically between 2000 and 2007 in a number of systematic large-scale national and international studies.

- The National Systemic Evaluation (NSE)
- Southern and East African Consortium for Monitoring Educational Quality (SACMEQ)
- Trends in Mathematics and Science Study (TIMSS)

# PROPORTION OF LEARNERS WHO DID NOT ACHIEVE MINIMUM EXPECTED STANDARDS BY STUDY BETWEEN 2000 AND 2007

| NSE | SACMEQ | | TIMSS |
|---|---|---|---|
| Grade 6: 2005 | Grade 6: 2000 | Grade 6: 2007 | Grade 8: 2003 |
| 81% | 85% | 85% | 82% |

All of these early large-scale studies converged around the astonishing finding that around 80% of learners at two grade levels in primary schooling in four different nationally representative samples over a period of seven years were attaining scores below the minimum expected performance levels for the grades in which they were currently enrolled.

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# DECLINE IN NATIONAL MEAN SCORES FOR ANA MATHEMATICS FROM GRADE 1 TO GRADE 9 IN 2012, 2013 AND 2014 (%)

| | Grade 1 | Grade 9 | Change |
|---|---|---|---|
| 2012 | 68 | 13 | -55 |
| 2013 | 60 | 14 | -46 |
| 2014 | 68 | 11 | -57 |

In 2012, by Grade 3 the mean figures were below what can reasonably be regarded as a realistic ‘pass mark’ of 50%. By Grade 6, the mean dropped below the currently applicable pass mark of 30% and the mean for Grade 9 was a disastrous 13%.

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# BACKLOGS IN 2021: BASELINE STUDY OF THE ZF BACKLOGS PROJECT EVALUATION

Data for this study were obtained through an 81-item diagnostic instrument based on Content Areas One, Two and Three. The instrument was made up of items standardized against the requirements for Grades 4, 5, 6 and 7 of CAPS. It was administered at Grade 8 level and, therefore, reflected the content of the four grades levels which learners had already completed and from which they had been promoted. It was administered to 678 learners in 35 schools in Gauteng, the Buffalo City area and the Wild Coast of Transkei.

| Grade 4 | Grade 7 | Difference | Whole test |
|---|---|---|---|
| 43,9% | 23,8% | -20,2% | 33,8% |

Figures similar to these are typically obtained during smaller-scale programme evaluations where absolute scores vary according to the design of the intervention and the test instrument. *However, underlying these variations in mean scores is a consistent and significant decline from lower to higher grades irrespective of the value of the initial starting point.*

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# CAUSES OF POOR LEARNER PERFORMANCE

The educational literature concerning explanations for poor learner performance is extensive – too large to summarize here. Suffice it to say that the most commonly noted factors include poor school management and educational functionality, low SES, race, unqualified teachers, language, level of provisioning, nutrition, level of parental education, location, and so on.

Some of these problems have already been addressed, or are being addressed, on a national level – nutrition by the National Schools Nutrition Programme (NSNP), for example, as well as significant shifts in funding towards historically disadvantaged schools, the racial transformation of historically advantaged schools and the supply of qualified teachers.

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# CAUSES OF POOR LEARNER PERFORMANCE

All of these explanations are plausible, to one degree or another, but they do not explain all of the variation in learner performance scores. Gustafsson and Mabogoane (2010), showed that in South Africa, as in a number of other countries "relatively high public spending and even well qualified teachers can easily co-exist with very poor education outcomes". In fact, in South Africa, measures of poverty, resource provision, race, class sizes and teacher supply still left some 30% of the variation in the performance of South African schools unexplained.

Nor can these explanations explain why learner performance in the matriculation examinations of high performing mathematics schools in terms of learners passing at 30%, 50% and 60% has been declining since 2008. (Mouton & Schollar, 2014). They DO explain why the performance of these learners is better than those in poorly performing schools but they cannot *also* explain these declines.

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# CAUSES OF POOR LEARNER PERFORMANCE

The literature provides extensive support to the proposition that the introduction of Outcomes Based Education (OBE) was the fundamental initial cause of poor outcomes in mathematics in South Africa and elsewhere after 1994. There is no space to review this literature but suffice to say that the encouragement of teaching methods in an underspecified curriculum that rejected memorization as ‘rote learning’, direct instruction as ‘spoon feeding’ and repetitive practice as meaningless ‘donkey work’ - in favour of collaborative learning in groups, discovery learning and the relegation of teachers to the role of ‘facilitators’ - was, and is, singularly inappropriate for the learning of mathematics.

These methods run counter to the implications for education of the findings of the developing field of neurocognitive science. (Abadzi, 2006; Kirschner, Sweller and Clark, 2006)

# CAUSES OF POOR LEARNER PERFORMANCE

Declining scores across all grade levels were subsequently accompanied by a reduction of demand in terms of the ‘pass mark’ which is currently set at 30% - i.e. by changes to assessment policy. Backlogs throughout the system, as we have seen, are the result.

They also prompted a potentially more useful response – the introduction of streaming after Grade 9 in the form of Mathematical Literacy as a subject. In fact, I believe that there is a strong argument for the establishment of three streams of mathematical education:

- The current curriculum for the ‘academic’ stream
- An adapted curriculum for the ‘technical’ stream
- The Mathematical Literacy curriculum for the ‘vocational’ or ‘life’ stream.

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# CONCLUSIONS AND RECOMMENDATIONS

Significant backlogs in the grasp of mathematical content knowledge of learners are widespread throughout the education system in all provinces and at all grade levels. The great majority of South African learners have attained competency levels at least one, and typically more, grade levels below the grades in which they are currently enrolled. The great majority of classes have all become, in effect, multi-grade defined more by age cohort than by attained competency cohort.

These backlogs pose the single most significant barrier to the improvement of the outcomes of mathematical education in South Africa. They are also the most significant barrier to the ability of teachers to cover the whole of the curriculum at the correct pitch to each grade.

We are caught in a circular trap. The greater the backlog, the slower curriculum delivery; the slower curriculum delivery, the wider backlogs become.

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# CONCLUSIONS AND RECOMMENDATIONS

In terms of systemic national solutions, it appears self-evident to the author that the objective of assessment policy should be to ensure a reasonably consistent flow of learners who have attained the minimum required standards from one grade to the next.

Given the current massive level of heterogeneity in learner abilities within and across all grade levels, changed assessment policies of this type will have to be implemented progressively from Grade 1 onwards, potentially taking 12 years before their full effect, and the stabilization of the system, can be achieved.

Since, as I understand it, the DBE has recently decided that automatic progression will be applied across the Foundation Phase this option is not likely to be introduced any time soon.

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# CONCLUSIONS AND RECOMMENDATIONS

The most immediate recommendation to be drawn from this analysis is that any mathematical curriculum, or educational development intervention programme, should be based on a diagnostic and remediation process whether that remediation is applied through some form of streaming, or through (the much more difficult) combination of diagnostic testing and differentiated education within one single mixed ability stream.

Intervention programmes that acknowledge there is a tension between [a] Catching up on content missed *within a grade level* and [b] Dealing with backlogs by remediating content missed *during previous grades*, have suggested a couple of potential solutions.

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# CONCLUSIONS AND RECOMMENDATIONS

One intervention, for example, simultaneously focusses support on both issues. This intervention model provides a support programme pitched at the correct content grade levels combining INSET, materials provision (lesson plans) and on-site support for teachers. This input is complemented by the regular and sustained use of a computer-based programme providing extensive learner practice on the progression of mathematical skills. These programmes typically require learners to solve a sufficiently high number of items correct at each level of complexity before they are directed to the next level.

Perhaps most importantly from the point of view of neurocognitive science, they provide multiple opportunities for learners to practice mathematics just above their level of attained competence and tend to increase fluency, accuracy and confidence.

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# CONCLUSIONS AND RECOMMENDATIONS

Another potential intervention model operates two developmental programmes. The first is targeted at the incoming Grade 3 (or Grade 7) class and provides a diagnostic and remediation process that is intended to reduce the size of existing learner backlogs. Teachers in higher grades should achieve extra efficiency through better prepared learners allowing them to focus more closely on covering more of the curriculum - though some remediation may still be necessary.

The second is targeted on Grade 7 (or Grade 11 and 12) and aims at improving the ability of learners to cover the whole curriculum for the current grade/s at the correct pitch. This task is made more feasible by the improved flow of better prepared learners and, in secondary schools, the departure of many learners to ‘life maths’ in the form of Mathematical Literacy.

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# CONCLUSIONS AND RECOMMENDATIONS

My own doctorial research (Schollar, 2015) in remote rural schools in NE Limpopo showed that it is possible to double baseline scores of learners over a period of 14 weeks using a model of differentiated education based on diagnostic testing directing learners to workbooks containing different grade content levels, direct instruction by teachers and the recognition of the importance of memory and, especially, extensive opportunities to practice.

In operational terms, it was possible to present this programme in full and as it was designed because the provincial department suspended the District ATP to allow for the exclusive use of the intervention programme in the schools concerned. Without their own 'space' within which to operate, intervention programmes can be subjected to extrinsic and contextual conditions that actively militate against the possibility of achieving impact irrespective of the intrinsic value of the intervention model, making evaluation studies almost meaningless.

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