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The Quality of Primary Mathematics Teacher Preparation in SA

Findings from PrimTEd

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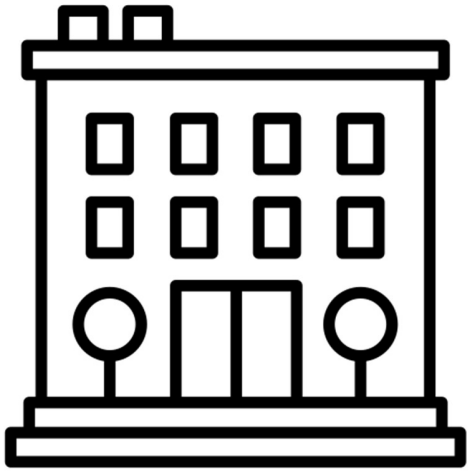


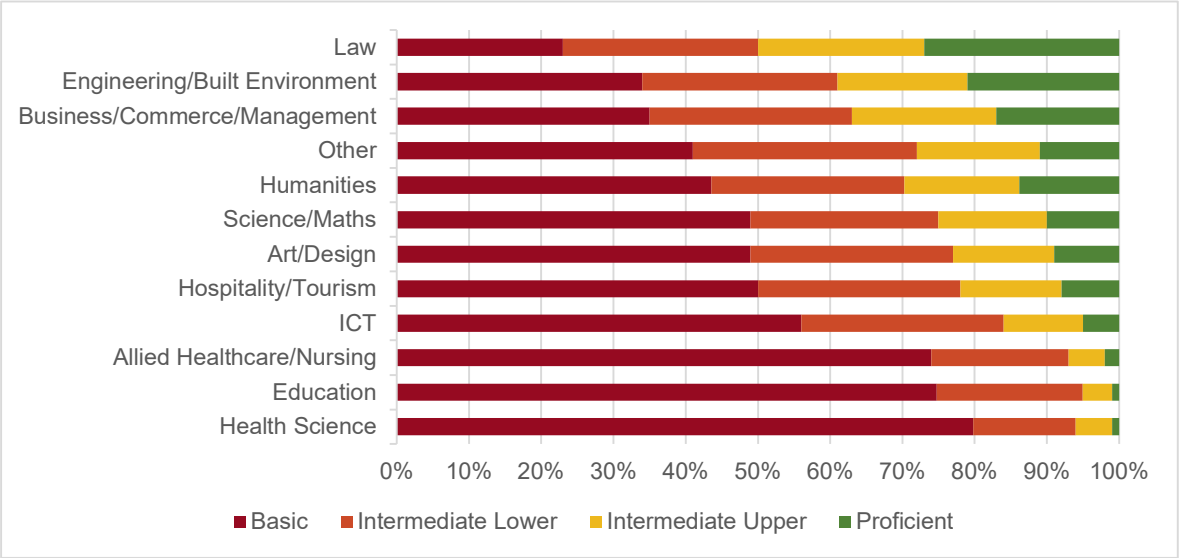
RESEP
Research on Socio-Economic Policy

Teacher **D**emographic **D**ividend.

This report provides an overview of key findings from the Primary Teacher Education Development (PrimTEd) project for the period 2018-2021. PrimTEd is a voluntary collective of 25 universities with the aim of monitoring the performance of students in Initial Teacher Education (ITE) programmes for primary school teachers. Assessments in Mathematics and English (First Additional Language) have been collaboratively developed and administered regularly. This enables the use of assessment data as a rich source to improve teaching and learning. The findings in this report are drawn from mathematics assessments that were administered to Foundation Phase and Intermediate Phase ITE students at first and final (fourth) year in the Bachelor of Education (B.Ed) programmes in PrimTEd universities.

First year students entering primary education B.Ed programmes have very weak mathematical skills. Universities start where secondary schools finish, so many first-year students have weak mathematics literacy results, and very poor mathematics knowledge. Candidates applying to education faculties at universities have weaker quantitative literacy skills (as measured by the NBTs) than candidates applying to any other faculty except Health Science (Figure 1). About 75% of applicants to Education perform only at the Basic level for quantitative literacy. The Intermediate Upper level is regarded as a requirement for success at university.

***Figure 1**: 2018 NBT Quantitative Literacy performance levels (n=18,000) by intended faculty of study*



Source: NBTP Team at CETAP. (2019). The National Benchmark Tests National Report.

The PrimTEd mathematics assessment was developed as a reasonable measure of what might be expected of teachers completing a primary B.Ed programme. It was administered at two points in time – at the beginning and end of the B.Ed programme. The initial PrimTEd test comprised a set of 50 mathematics items in a multiple-choice format that assess students' "mathematical knowledge for teaching". The 90-minute test is administered online under invigilation of at least one lecturer. The test items are categorized in relation to the mathematics content domains: whole number and operations (24%), rational number and operations (38%), patterns, functions and algebra (16%), geometry (8%) and measurement (14%). The items are also classified as either lower or higher cognitive demand as stipulated by Stein, Grover and Henningsen's (1996) framework on tasks.[1] Exemplar items are given in Figure 2.

Attainment in the PrimTEd mathematics assessment is weak at both first- and fourth-year levels. Across all institutions which participated throughout the three-year project period (2017-2019), the mean result of first year students was 47.6%. The mean result for fourth year students was 52.5% (see Figure 3).

As such, the improvement in mathematical knowledge between first- and fourth-year students was only 5 percentage points. However, standards-based reporting shows that there are positive shifts in the attainment level when comparing first years to fourth years (see Figure 4).

***Figure 2**: Exemplar items from the PrimTEd mathematics assessment*

Exemplar item 1: Rational number, low cognitive demand
0,7 is a decimal fraction.
Write 0,7 as a common fraction.

Exemplar item 2: Rational number, high cognitive demand
A farmer's cost for milk production is R3,12 for each litre. What are his production costs for 2,5 litres of milk? The calculation you need, to get the correct answer is:

A. 3,12 × 2,5
B. 3,12 - 2,5
C. 2,5 ÷ 3,12
D. 3,12 ÷ 2,5

***Figure 3**: PrimTEd Mathematics test – mean results (2017-2019)*

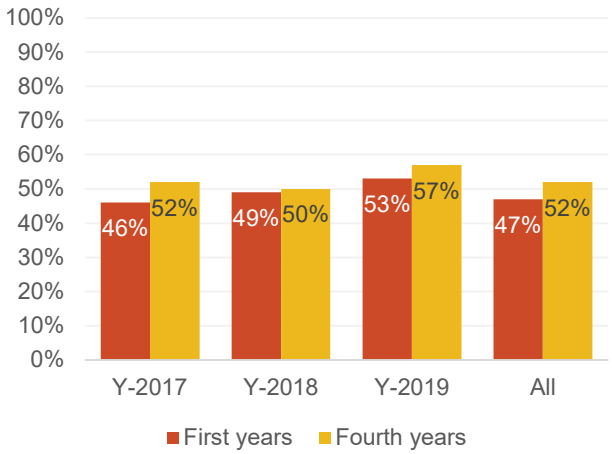
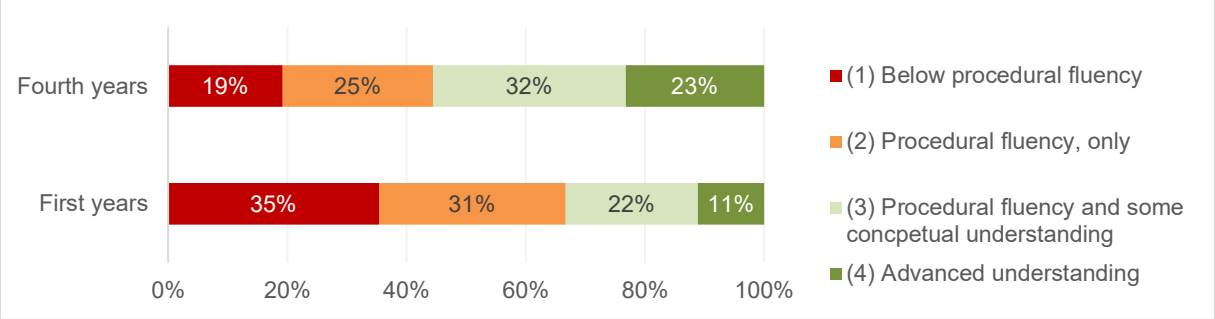


***Figure 4**: PrimTEd Mathematics attainment levels 2017-2021 (first years n = 3799, fourth years n = 1062)*



It is evident that some of the mathematics (and mathematics literacy) deficiencies that student teachers bring from school persist to the end of the four-year B.Ed programmes. This presents a challenge to universities and also suggests that the vicious cycle of schooling and ITE reported in Taylor (2019)[2] is yet to be broken.

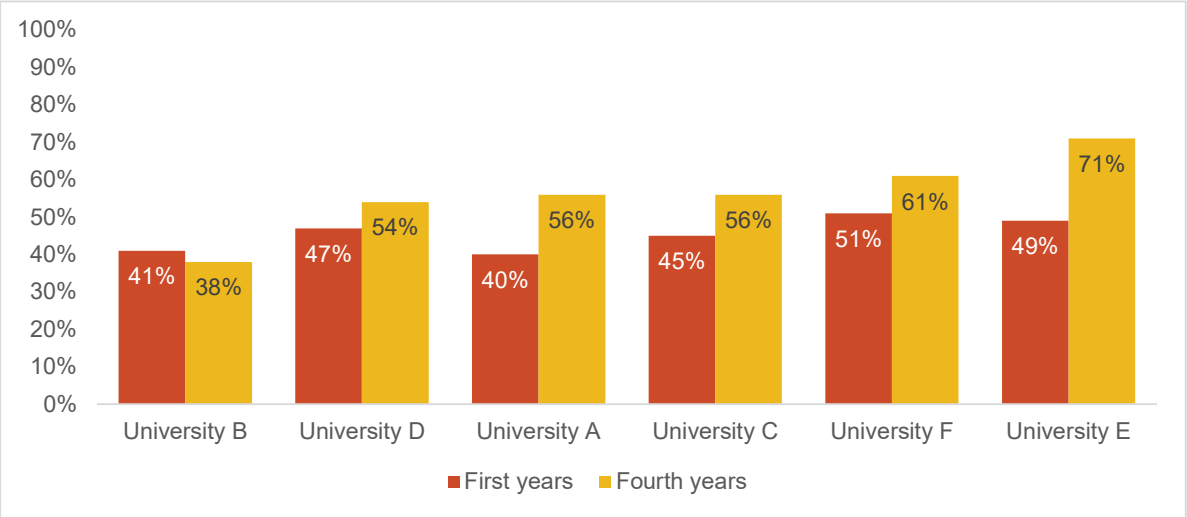
The PrimTEd process is driven by ITE lecturing staff themselves, who are very concerned about this lack of progress from first to fourth year. Accordingly, they have sought ways to collaborate and improve mathematics course offerings. These academics have agreed on PrimTEd knowledge and practice standards for mathematics. There is clear evidence of ITE lecturer appetite for change and for gaining specialized skills in the mathematical knowledge that is required for teaching well at primary school level.

Reasons for the lack of progress are varied: insufficient course alignment to PrimTEd standards, poor entry level mathematics, insufficient training and knowledge amongst ITE lecturers for primary school (many of whom have a secondary school mathematics specialisation), and insufficient time in the B.Ed programmes to work with students on their mathematics knowledge for teaching.

The lack of time allocated to mathematics in B.Ed programmes is a serious constraint. In 2020, mathematics lecturers in 6 universities applied for funding to improve their course offerings (through the Maths 4 Primary teachers project). Across these six universities, credit weightings for mathematics range from 5% to 17% of the 480 credits in the B.Ed degrees. This is a very small proportion of the total credits.

Some variation is evident in PrimTEd mathematics results across universities, as shown in Figure 5. Universities A and E show fairly large differences in their cross-sectional data comparing first years to fourth years. Investigating the practices at these universities may provide valuable information about effective teacher education strategies.

***Figure 5**: PrimTEd Mathematics test – mean results by university (2017-2019)*



Given the above evidence, it is clear that there are several possible next steps, which require urgent attention:

1. The DHET should include a firm recommendation for the credit weighting in B.Ed programmes (Foundation and Intermediate Phase) for at least 100 credits in mathematics, and at least 120 credits for language and literacies;
2. Raise the entry requirements for incoming B.Ed entrants (prioritizing mathematics, and/or higher scores in mathematics literacy);
3. Consider extending the B.Ed to a five year programme, with a first year focused on mathematics, language and literacy;
4. Support the work of PrimTEd assessment beyond 2023;
5. Fund and support the ITE lecturers who acknowledge the seriousness of this problem, are seeking capacity building and are willingly collaborating to improve their mathematics course offerings; and
6. Ensure that the UNISA online courses are the best that can be offered, and draw on the innovations being designed and trialled at smaller scale in numerous other ITE sites.

[1] Stein, M. K., Grover, B. W., & Henningsen, M. A. (1996). Building student capacity for mathematical thinking in reasoning: An analysis of mathematical tasks used in reform classrooms. *American Educational Research Journal*, 33 (20), 455-488.
[2] Taylor, N. (2019). Inequalities in teacher knowledge in South Africa. In N. Spaull and J. D. Jansen (Eds.), South African Schooling: The Enigma of Inequality: A Study of the Present Situation and Future Possibilities. Springer, pp. 263-282.