The Initial Teacher Education Research Project

Report on performance in ITERP Maths test

Lynn Bowie

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JET EDUCATION SERVICES

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The Initial Teacher Education Research Project (ITERP) studied the BEd curricula for mathematics and language and literacy for teachers intending to teach in the Intermediate Phase at 5 universities (Taylor, 2014; Deacon, 2016). In addition, tests in maths and English were used to assess the extent to which samples of 4th-year students and newly qualified teachers (NQTs) from these universities had mastered the content of these subjects, at the level the primary school curriculum.

This document provides a summary of the performance of the 4th year students who wrote the pilot test in 2014 and the NQTs who wrote the revised test in 2015.

It should be noted from the outset that these two groups differed substantially in composition and neither group could be considered a representative sample of either 4th year students or NQT in SA or even from the 5 case study institutions. The NQT and 4th year students were either intending to be Senior Primary (grades 4 – 7) or Intermediate Phase and Senior Phase (grades 4 – 9) teachers.

1. Results from the pilot test (4th year students, 2014)

University	Profile	Number of students	Number of mathematics specialists	Average Mark	Average of mathematics specialists
E	HDI, urban	10	0	29%	n/a
B	HAI, urban	7	5	49%	51%
C	Distance	0			
D	HDI, rural	158	46	26%	37%
A	HAI, urban	15	1	31%	57%
ALL		190	52	27%	39%

Key: HDI – historically disadvantaged institution; HAI – historically advantaged institution

The results from the pilot test show a very poor performance in the test with the average mark of all those who wrote being 27%. The test consisted of items requiring knowledge of the mathematics content from the Intermediate Phase and Senior Phase. The number of students from campuses other than university D are very small and thus it is not useful to compare performance across the campuses. As one would expect the performance of those who indicated they were specializing in mathematics was better than the general performance. However, given that these students are likely

to become the specialist mathematics teachers in the school the average mark of 37% is of concern.

2. Results from the NQT workshop

University	All (passed)	Specialised in maths	Are teaching maths	Average all	Average specialists
E	9 (7)	2 (2)	8 (6)	62%	74%
B	4 (4)	3 (3)	2 (2)	72%	75%
C	6 (4)	4 (3)	3 (2)	50%	57%
D	2 (0)	0	0	30%	n/a
A	9 (5)	3 (3)	4 (3)	51%	63%
ALL	30 (20)	12 (11)	17 (13)	55%	66%

The number of NQTs who wrote the revised test was small and unfortunately not evenly spread across the case study institutions. Their performance is significantly better than that of the 4th year students in the pilot test. Because of the performance of the students on the pilot test, the revised test was made easier than the pilot test. However these differences were not substantial[1]. The level of content on the test was at IP (58%) or SP (42%), and thus at or just above the level of the mathematics the NQTs will be teaching. The performance of the NQTs is thus not at the level we would hope.

3. Performance on specific sets of questions

The tables below give the average mark of the students and NQT on specific subsets of questions from the test.

	PILOT (190 fourth year students, 2014)	NQT (30 NQT, 2015)
IP content	33%	66%
SP content	20%	41%
Questions related to pedagogy	8%	44%
Lower cognitive demand	39%	67%
Higher cognitive demand	33%	50%

Both the fourth year students and NQTs performed better on the Intermediate Phase content than on the Senior Phase content. This is unsurprising. However it is important to note that the 4th year students averaged 33% on the IP content, and as

[1] Questions that were altered are indicated in section 4 below with a *. In addition a challenging question worth 1 mark that no students in the pilot test got correct was removed in the revised test.

most IP teachers are likely to have to teach grade 4 or 5 mathematics at some point in their careers, this is a big concern.

The questions relating to pedagogy were very badly answered in the pilot test. There are potentially a number of reason for this. It is difficult to ask pedagogical question and students might be unfamiliar with that style of question and thus uncertain of how to answer these types of questions. In addition the pedagogy questions required use of language to provide explanations and it was noted during the marking that a number of the students in the pilot test appeared to struggle providing coherent explanations in English. Anecdotal evidence from the marking suggested that some students might not know the mathematics that they were being asked to provide a pedagogical approach towards. Thus the questions were amended so that the mathematics question was asked first before the pedagogy question was asked. This breaking up of the question might have made it easier. In addition, work was done on all the pedagogy questions to make them clearer and, in some cases, easier.

The performance on lower cognitive demand questions give us an indicator of whether the students/NQT were able to perform the basic procedures and calculations e.g. adding two numbers or multiplying a decimal by 100. These kind of questions would be questions that we would expect learners in the IP or SP to be able to do routinely. Thus we would expect the students/NQT to have no problem with these. This was not the case. The higher cognitive demand questions required the students/NQT to have some insight into the concepts involved. They were not necessarily particularly difficult questions. We would expect, and want, teachers to be able to do this kind of question as they need to understand the mathematics they will be teaching.

4. Question by question performance

The tables below show the questions on the test, the content area they covered, the phase (Intermediate Phase or Senior Phase), the type of knowledge domain (lower cognitive demand, higher cognitive demand, pedagogy) and the average performance (as a percentage) of the 4th year students on the pilot test and the NQTs on the revised test. Where changes were made to the pilot test, the question from the revised test is provided and a * indicates that a different version of the question was used in the pilot test.

Acknowledgement

The cooperation of staff at the five institutions studied is gratefully acknowledged. Aside from important ethical considerations, in the interests of keeping the principles of ITE in view, rather than focusing on particular institutions, strict anonymity of the institutions and individuals involved will be maintained.

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ITERP is led by Nick Taylor and managed by Aneesha Mayet, with administrative support from Deidre Davids. The research was conducted by Lynn Bowie, Carol Bertram, Maryla Bialobrzeska, Roger Deacon, Adele Gordon, Ken Harley, Yvonne Reed, Lee Rusznyak and Tessa Welch.

References

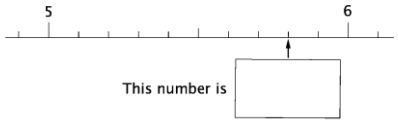
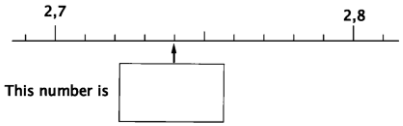
Bowie, L. (2014). *Report on mathematics courses for Intermediate Phase student teachers at five universities.* Johannesburg: JET Education Services.

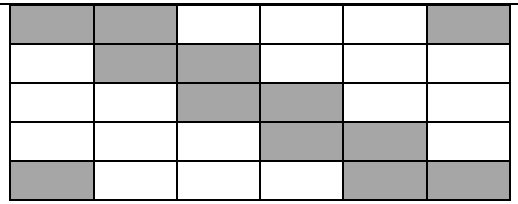
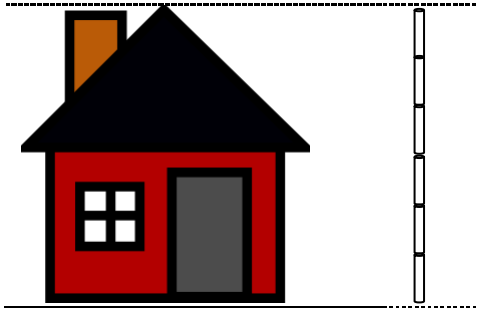
Deacon, R. (2016b). *Initial Teacher Education Research Project: Final Report.* Johannesburg: JET Education Services.

Taylor, N. (2014*). Initial Teacher Education Research Project: An examination of aspects of initial teacher education curricula at five higher education institutions. Summary Report.* Johannesburg: JET Education Services.

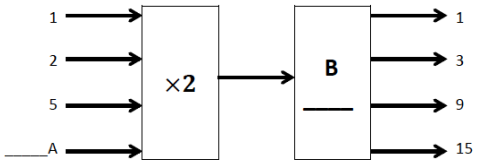
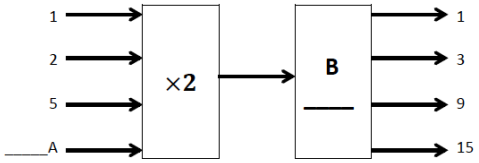
	Question	Content	phase	type	Pilot	NQT
1	A choir has 35 members. The ratio of girls to boys is 5:2. How many girls are there in the choir?	ratio	IP	Lower	33	62
2	$1\frac{1}{4} \div \frac{3}{4} =$	fraction	SP	Lower	21	40
3a	Calculate 53,08 times 100	Decimal basics	IP	Lower	45	63
3b	Express 0,4 as a fraction in simplest form.	decimal to fraction	IP	Lower	35	50
3c	Calculate 2495 + 760,7	Decimal calculation	IP	Lower	63	77
3d	Calculate 5000 -1093	Whole number calculations	IP	Lower	49	80
4ai	Circle the number nearest in size to 181 82 180 190 200	Whole number basics	IP	Lower	87	100
4aii	Circle the number nearest in size to 2,9 3 30 2 20	Decimal basics	IP	Lower	88	97
4aiii	Circle the number nearest in size to 0,18 0,1 0,02 0,2 20	Decimal basics	IP	Lower	61	83
4b1	Circle the number that is nearest in size to the answer (do not work out the arithmetic) 2,9 x 7,1 = 0,02 0,2 2 20	Decimal calculations	SP	Higher	78	90

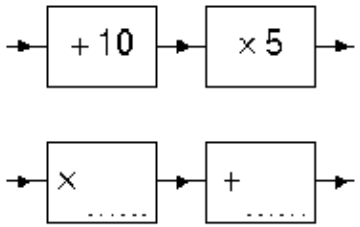
4bii	Circle the number that is nearest in size to the answer (do not work out the arithmetic) 0,29 x 7,1 = 0,002 0,02 0,2 2	Decimal calculations	SP	Higher	52	47
4biii	Circle the number that is nearest in size to the answer (do not work out the arithmetic) 59 ÷ 190 = 0,003 0,03 0,3 3	Decimal calculations	SP	Higher	38	47
5a	For each scenario given below, write the calculation you would need to do in order to get the answer. **You do NOT need to do the calculation**. A table is 92,3cm long. About how many inches is this length (1 inch is about 2,54 cm)?	decimal word problems	SP	Higher	43	70
5b	Your friend lends you R6,44 so that you can pay a bill for R8,37. How much money did you put in?	money word problems	IP	Higher	71	93
5c	A farmer's cost for milk production is 88,2 cents for each litre. What are his costs for producing 0,58 litres of milk?	decimal word problems	SP	Higher	53	53
5d	The cost of 6,22 litres of petrol in England was £4,86. What would the price of 1 litre be?	decimal word problems	SP	Higher	26	43
6	Circle the correct answer: 12,3 ÷ 0,15 has the same answer as A 123 ÷ 0,015 B 123 ÷ 1,5	Decimal calculations	SP	Higher	29	67

	C 123 ÷ 15 D 123 ÷ 150					
7a		decimal basics	IP	Higher	78	90
7b		decimal basics	IP	Higher	54	87
7c*	What number is halfway between 14,6 and 14,7?	decimal basics	IP	Higher	56	80
7d*	Calculate 1 ÷ 5 and write your answer as a decimal number.	decimal basics	IP	Higher	45	70
8a	6% of children in a grade get school fee exemption. There are 250 children in the grade. How many children get school fee exemption?	percentage	IP	Lower	42	67
8b	A newspaper says that 24 out of 800 Avenger cars have faulty engines. What percentage of the 800 cars have faulty engines?	percentage	SP	Lower	31	40
8c	The price of a scarf is R20. In a sale, it is reduced by 5%. How much does it cost now?	percentage	SP	Lower	32	63
9	My monthly salary has been increased by 20% and is now R24 000. How much was my salary before the increase?	Percentage – work backwards	SP	Higher	11	27

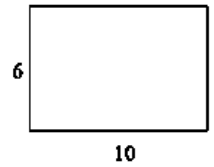
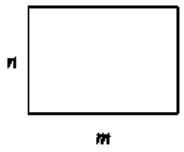
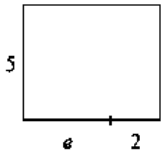
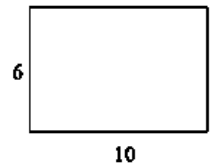
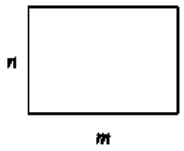
10	Without working the two answers out, say which is larger and why you say so. A: $72{,}4 \div \frac{7}{8}$ B: $72{,}4 \times \frac{7}{8}$	fraction	SP	Higher	9	23
11	 What percentage of the grid is shaded?	percentage	IP	Lower	30	50
12	I've drawn a big house and a small house on the blackboard. The small house:  You can see that the small house is 6 pieces of chalk high When I measure the height of the houses using pencils, the small house's height is four pencils and the big house's height is six pencils. How many pieces of chalk do we need for the big house's height?	ratio	IP	Higher	15	37
13ai	Solve the word problem, showing all working clearly: I want to divide 3 pizzas	fraction	SP	Lower	n/a	83

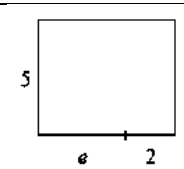
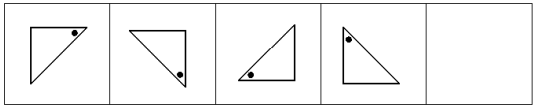
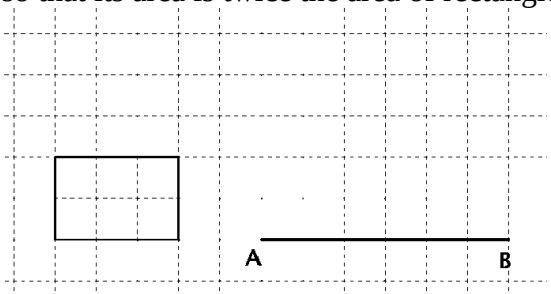
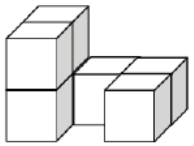
	between two children fairly. How much pizza will each child get?					
13aii	Would the word problem "I want to divide 3 pizzas between two children fairly. How much pizza will each child get?" be a good word problem to illustrate 3 divided by ½? Explain why you say so.	fraction	pedag	Pedag	9	27
13bi	Solve the word problem, showing all working clearly: A child has 3 chocolates. The number of chocolates the child has is doubled. How many chocolates will the child have now?	fraction	SP	Lower	n/a	87
13bii	Would the word problem "A child has 3 chocolates. The number of chocolates the child has is doubled. How many chocolates will the child have now?" be a good word problem to illustrate 3 divided by ½? Explain why you say so.	fraction	pedag	Pedag	9	50
13ci	Solve the word problem, showing all working clearly: I have 3 metres of ribbon. I am making bows that each require $\frac{1}{2}$ metre of ribbon. How many bows will I be able to make?	fraction	SP	Lower	n/a	87
13cii	Would the word problem " I have 3 metres of ribbon. I am making bows that each require $\frac{1}{2}$ metre of ribbon. How many bows will I be able to make? " be a good word problem to illustrate 3 divided by ½? Explain why you say so.	fraction	pedag	Pedag	8	63
14a	A learner in your class calculates that 2,6 + 3,7 = 5,13 and that 4,5 + 12,6 = 16,11. Explain what this learner is doing incorrectly.	decimals	pedag	Pedag	14	73
14bi	How you would correctly calculate 2,6 + 3,7? Show all steps clearly.	decimals	IP	Lower	n/a	73
14bii	The learner, who did the calculation incorrectly in the way shown in question 14a, in your class says "I don't understand why your way is right and my way is wrong." What diagrams, models or explanations could you use to help the learner **understand** why your way is correct and their way is incorrect.	decimals	pedag	Pedag	2	18

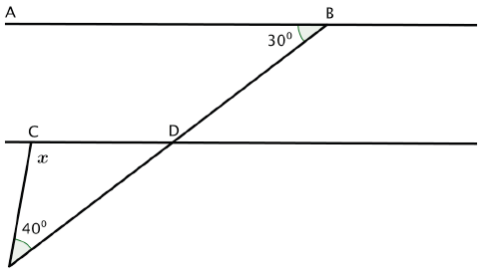
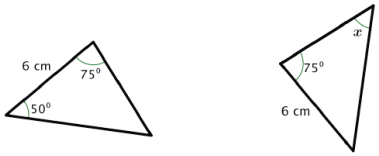
15	Provide a realistic word problem that would lead to the calculation $\frac{1}{2} - \frac{1}{6}$. Pay attention to how you phrase the word problem so that it is clear and unambiguous.	fractions	pedag	Pedag	2	7
16*	A learner says that she doesn't understand why $2\frac{1}{4} = \frac{9}{4}$. Show how you could use **pictures** to help her understand **why** this is true. Provide a brief explanation alongside your pictures.	fractions	pedag	Pedag	1	57
17	If 630 × g = 420 what is the value of: 630 × g + 80 Circle the correct answer: 1130 510 500 710	algebra	SP	Higher	48	73
18a	Replace A with a number in the flow diagram below. 	algebra flow diagram	IP	Lower	35	83
18b	Replace B with a rule in the flow diagram below. 	algebra flow diagram	IP	Lower	31	87

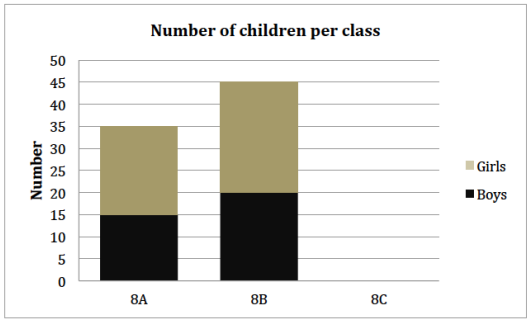
19a	Chip packets cost R8 each and tins of soup cost R6 each. If c stands for the *number of chip packets* bought and t stands for the *number of tins of soup* bought, what does the expression 8c + 6t stand for	algebra word problem	SP	Higher	3	10
19b	Write an expression for the total number of items bought?	algebra word problem	SP	Higher	10	7
20	Piet wrote down a pattern using As and Bs. The pattern repeats itself after every four letters. Below is the beginning of this pattern with a few of the letters left out. Fill in the missing letters. A B _ _ A _ B _ _ _ _ A	pattern	IP	Higher	11	53
21	When you feed a number into this machine, it does the operations shown, and passes the answer out. Can you find another machine that has the same overall effect, whatever number you put in 	Flow diagram, understand operations	IP	Higher	4	3
22	Write down the smallest and the largest of these five expressions. n + 1 n + 4 n – 3 n n – 7	algebra	SP	Higher	65	73

23	Determine the value of x: $(2 + 2x) \times 6 = 48$ Circle the correct answer: **A.** 3 **B.** 6 **C.** 2 **D.** 25	algebra	SP	Lower	48	63
24a	You ask your grade 5 learners to fill in the missing number: $23 + 36 = \_\_\_\_ + 19$ To answer it **correctly**, what number should they fill in?	equality	IP	Lower	n/a	87
24b	What common mistake do you think learners might make and why do you think they might make this mistake?	equality	pedag	Pedag	23	33
25	A tray of food is placed in the oven at 07:40. It needs to bake at a low temperature for 2,5 hours. At what time must the tray be taken out of the oven?	Time calculation	IP	Lower	33	73
26	Two friends are walking around a field which is a rectangle 90m long and 50m wide. They leave the starting point at the same time and walk in the same direction. One friend walks 1 ½ times as fast as the other. How many times will the slower friend have walked around the field before they meet again at the starting point.	rate	SP	Higher	8	10
27a	What is the area?	area	IP	Lower	55	77

						
27b	What is the area? 	area	SP	Lower	51	57
27c	What is the area? 	area	SP	Lower	6	13
27d	What is the perimeter? 	perimeter	IP	Lower	22	60
27e	What is the perimeter? 	perimeter	SP	Lower	13	47
27f	What is the perimeter?	perimeter	SP	Lower	6	17

						
28	Draw the next figured in the space provided: 	geom visualisation	IP	Lower	17	60
29*	Rectangle 1 has been drawn on the grid below. Draw a rectangle with length AB, so that its area is twice the area of rectangle 1 	area	SP	Higher	11	23
30	Which 2-D shape below shows the top view of the 3-D object?  Front view (4 options given for them to chooose from)	geom visualisation	IP	Lower	65	83

31	In the diagram below, AB is parallel to CD. What is the size of the angle marked *x*? 	geometry	SP	Higher	18	47
32	The two triangles below are congruent. They are not drawn to scale, but measurements of some of their sides and angles are shown. What is the value of *x*?  	geometry	SP	Higher	19	40
33a	A learner believes that since 1 cm = 10 mm it must follow that 1 cm^2 = 10 mm^2. Fill in the number to show the correct way to convert cm^2 to mm^2 1 cm^2 = _____mm^2	measurement	SP	Lower	n/a	50
33b*	Use pictures and explanations to show how you would help the learner to correct the misconception and **understand** the correct conversion?	measurement	pedag	Pedag	0	25
34a	A graph is used to summarise the number of boys and girls in Grade 8. The information for class 8C is missing.	data	IP	Lower	22	73

	 There are 126 children in Grade 8 and 18 girls in 8C. How many boys are there in 8C?					
34b	How would you demonstrate the way to work this problem out to grade 6 learners? Show the solution step by step.	data	pedag	Pedag	18	78
35	Each week Sihle writes a maths quiz which is out of 10 marks. The mean mark for her first 10 quizzes was 4,5. For her 11^{th} quiz she gets 7 out of 10 and for her 12^{th} quiz she gets 8 out of 10. What is her mean mark for all 12 quizzes?	data	SP	Higher	5	23