Table 1. Overall Cognitive Scores

	Overall Cognitive Scores (Percentages)
M	40.2
SD	18.0
Min	4.8
Max	92.9

Table 2. Pre-service mathematics teacher strengths: Curriculum-aligned content of items with a cognitive proficiency rate over 40%

Topic	Item	Level: JC/LC*	Curriculum Content Strand	Proficiency Rate (%)	*SD*
Making predictions about what comes next in a pattern	13a	JC	Algebra & Functions: Representing situations with tables, diagrams and graphs	91.0	27.5
Solving problems involving shopping: % discount; Performing calculations with percentages	12	JC	Number: Applied arithmetic	64.3	34.4
Properties and equations of a line – slope, x/y intercepts; Relationship between the slopes of parallel lines; Labelling axes w/ appropriate scales	9	JC	Geometry & Trigonometry: Coordinate Geometry	60.6	35.5
Properties of a Square; Applying Pythagoras's Theorem; Operations with Surds	8	JC	Geometry & Trigonometry: Synthetic Geometry; Trigonometry	58.3	34.5
Relationships between the number systems	11	JC	Number: Number Systems	46.3	37.8
Probability: Finding the probability of equally likely outcomes	2	JC	Statistics & Probability: Equally Likely Outcomes	46.0	49.7
Representing Data Graphically: Mean vs. Median	3	LC	Statistics & Probability: Representing Data Graphically	45.0	49.9

* JC and LC indicate Junior Certificate and Leaving Certificate – Ordinary level is assumed, unless otherwise noted.

Table 3. Pre-service mathematics teacher weaknesses: Curriculum-aligned content of items with a cognitive proficiency rate below 40%

Concept(s)	Item	Level: JC/LC*	Curriculum Content Strand	Proficiency Rate (%)	SD
Writing an arithmetic expression for the terms in a sequence	13b	JC	Algebra & Functions: Generating arithmetic expressions from repeating patterns	38.7	39.8
Standard Deviation	4	LC	Statistics & Probability: Representing Data Graphically	35.0	47.8
Mean vs. Median	6	LC	Statistics & Probability: Representing Data Graphically	29	46.1
Count the number of ways to select r objects from n distinct objects	1	LC (HL)	Statistics & Probability: Counting	28.0	45.6
Recognize a bijective function and find its inverse	15a	LC (HL)	Functions: Functions	26.3	42.4
Differentiation	15b	LC	Functions: Calculus	25.3	32.5
Solve simultaneous equations with two variables and interpret results	16a	LC	Algebra: Solving equations	25.3	39.5
Graph of the function $f(x) = x^3$; Transformations $f(x) + a$; Graphs of inverse functions are reflections over $y = x$.	14	LC	Functions: Functions	25.3	23.8
Median	7	LC	Statistics & Probability: Representing Data Graphically	20.0	39.5
Interquartile Range	5	LC	Statistics & Probability: Representing Data Graphically	19.0	39.5
Associate derivatives with slopes and tangent lines	17	LC	Functions: Calculus	19.3	39.5
Relationships between number systems	10	JC	Number: Number Systems	18.0	38.6
Solve simultaneous equations with infinite number of solutions	16b	LC	Algebra: Solving equations	15.2	31.0

JC and LC indicate Junior Certificate and Leaving Certificate – Ordinary level is assumed, unless otherwise noted.

Table 4. Overall Conceptual Scores

	Occurrence Rate for Potential Conceptual Errors (Percentages)
M	45.8
SD	17.6
Min	7.7
Max	77.8

Table 5. Pre-service mathematics teachers: Conceptual error rates for curriculum-aligned content of items

Item #	Strand	Level		Concepts required for item completion	Response Rate (Percentages)	Occurrence Rate for Potential Conceptual Errors (Percentages)
		LC	JC			
1	1: S&P	LC		Counting: Count the number of ways of selecting r objects from n distinct objects	100	72.9
2	1: S&P		JC	Probability: Finding the probability of equally likely outcomes	94.1	51.3
3	1: S&P	LC		Representing Data Graphically: Mean vs. Median	90.6	51.4
4	1: S&P	LC		Representing Data Graphically: Standard deviation	87.1	59.5
5	1: S&P	LC		Representing Data Graphically: Interquartile range	82.4	77.1
6	1: S&P	LC		Representing Data Graphically: Mean vs. Median	85.9	65.8
7	1: S&P	LC		Representing Data Graphically: Median	81.2	73.9
8	2: G&T		JC	Properties of a Square	90.6	31.2
	2: G&T		JC	Applying Pythagoras's Theorem	90.6	44.2
			JC	Operations with surds	83.5	25.4
9	2: G&T		JC	Properties/Equations of a line - slope	90.6	42.9
	2: G&T		JC	x/y-intercept	90.6	45.5
	2: G&T	LC	JC	Relationship between the slopes of parallel lines	89.4	31.6
	2: G&T		JC	Coordinating the plane: labelling axes with appropriate scales	54.1	19.6
10	3: Num		JC	Number systems: Identifying Natural Numbers	95.3	12.3
	3: Num		JC	Number systems: Identifying Rational Numbers	95.3	22.2
	3: Num		JC	Identifying Prime Numbers	95.3	45.7
	3: Num	LC		Numbers systems: Complex Number is a + bi	95.3	80.2
11	3: Num		JC	Sets: Union	78.8	23.9
	3: Num		JC	Sets: Intersection	77.6	33.3
	3: Num		JC	Relationships between the number systems	77.6	53.0

Item #	Strand	Level		Concepts required for item completion	Response Rate (Percentages)	Occurrence Rate for Potential Conceptual Errors (Percentages)
		LC	JC			
	3: Num		JC	Applied Arithmetic: Solving problems involving shopping - % discount, selling price	94.1	37.5
12	3: Num		JC	Performing Calculations with percentages	92.9	24.1
	3: Num	LC	JC	Synthesis and Problem solving skills: Answering the question	90.6	31.2
13a	4: Alg		JC	Making predictions about what comes next in a pattern	90.6	3.9
13b	4: Alg		JC	Writing arithmetic expressions for terms in a sequence	67.1	59.6
	5: Fun		JC	Graph of the function $f(x) = x^3$	67.1	63.2
14	5: Fun	LC		Transformations $f(x) + a$	42.4	66.7
	5: Fun	LC		Graphs of inverse functions - reflection over $y = x$	30.6	84.6
	5: Fun	LC		Inverting functions	34.1	27.6
15a	5: Fun	LC		Properties of a function	32.9	25.0
	5: Fun	LC		Bijective functions	34.1	27.6
15b	5: Fun	LC		Differentiation	51.8	61.4
16 a	4: Alg	LC		Simultaneous equations w/ no solution are parallel lines	40.0	50.0
	4: Alg		JC	Equations of parallel lines have the same slope	40.0	50.0
16b	4: Alg		JC	Simultaneous equations w/ infinite number of solutions are the same line (same equations)	25.9	63.6
	5: Fun	LC		Derivative represents the slope of a curve	70.6	73.3
17	5: Fun	LC		Curves with the same slope/derivative are parallel	70.6	38.3
	5: Fun	LC		Negative slope indicates that the curve is decreasing	70.6	35.0

Table 6. Undergraduate degree and performance

Degree	N	Mean Cognitive Proficiency Rate (percentage)	SD	Mean Conceptual Error Rate (percentage)	SD
B.A. inclusive of Mathematics	47	41.7	14.8	46.0	18.0
B.Sc. inclusive of Mathematics	19	34.8	19.7	48.4	15.4
Engineering Degree	7	49.3	15.5	39.9	16.4
Business/Commerce	5	18.6	4.6	59.7	12.6
BSc. Non-Mathematics Specific	4	31.0	5.8	47.3	12.1
BSc. Mathematics & Physics	3	77.0	17.6	15.2	4.9