Evidence for Excellence in Education

Technical appendices

Research into the impact of Project Maths on student achievement, learning and motivation

independent • insights • breadth • connections • outcomes

Published in November 2013
by the National Foundation for Educational Research,
The Mere, Upton Park, Slough, Berkshire SL1 2DQ
www.nfer.ac.uk

Contents

Appendix A: Technical notes on statistical analysis

Appendix A describes the considerations and outcomes of the factor analysis and multi-level modelling undertaken as part of this research.

Factor analysis

Factor analysis is a statistical technique used to identify underlying factors in a large number of possibly correlated variables. In this case Principal Axis Factoring is employed, in which the first factor to be extracted is the linear combination of variables which explains the greatest amount of the variation in the data. Varimax rotation is used, which involves rotating the solution until the variance in the factor loadings is a maximum. This implies that loadings will either be large or close to zero and each factor will only be highly loaded on a subset of variables. This rotation scheme keeps the factors orthogonal (uncorrelated with each other). Before the analysis was carried out the data was re-coded so that high values represent a positive response.

The aim is to identify attitudinal outcomes of interest from the class of 2012 Junior Certificate and Leaving Certificate attitude surveys, especially confidence in mathematics. Four types of questions were put into the factor analysis for both surveys:

- different ways of working in mathematics lessons
- questions about what the teacher does
- feelings about mathematics
- how easy they would find different types of mathematics problems.

Factor loadings are the correlations between the factor and the original variables. Usually a value of 0.3 is used to identify important items, here any items loading 0.25 or more were considered. This was to ensure that all variables which may be useful were considered. The strongest factor for the Junior Certificate attitude survey has high loadings on the items relating to students' feelings about mathematics (e.g. 'I usually do well in maths') and some of the items about the teacher (Q6, e.g. 'my teacher thinks I can do well in maths'). The second factor is related to the questions about how easy they would find different types of mathematics problems (Q8, e.g. to solve problems using the properties of different shapes). For Leaving Certificate the items loading heavily on the first two factors are similar to the Junior Certificate survey but the factors

were reversed. The strongest factor involves questions about how easy they would find different types of mathematics problems (Q9) and the second factor includes items relating to the students feelings about mathematics (Q8) and some items about the teacher (Q7).

Factor leadings for Junior and Leaving Certificate students are set out in Table 1 and Table 2. Significant results are highlighted.

Table 1: Junior Certificate attitude survey rotated factor loadings

Variables included in the 'Confidence in mathematics' measure	Factor	
	1	2
Q7H I like maths	.787	.237
Q7D I enjoy learning maths	.755	.232
Q7G Maths is boring	.672	.163
Q7F I learn things quickly in maths	.611	.402
Q7A I usually do well in maths	.573	.367
Q7E Maths is not one of my strengths	.571	.323
Q7B I would like to take more maths in school	.459	.188
Q7C Maths is more difficult for me than many of my classmates	.451	.326
Q8H Use formulae to solve problems in measurement	.242	.578
Q8K Solve maths problems using what I have learned in more than one maths topic		.573
Q8D Solve problems using the properties of different shapes	.234	.557
Q8L Gather all the information available, and then use it to solve a particular maths problem	.217	.544
Q8E Solve problems using trigonometry	.260	.533
Q8B Draw charts like these to display my data		.500
Q8J Represent this relationship in a graph		.492
Q8F Use maths to solve problems based on real-life situations		.460
Q8I Solve problems using algebra	.363	.451
Q8C Make different shapes		.450
Q8G Understand indices	.196	.420
Q8A Work out the probability of something happening.	.164	.396
Q6G My teacher explains maths in ways that make it interesting	.339	
Q6H My teacher is easy to understand	.261	
Q6E My teacher thinks I can do well in maths	.311	

Table 2: Leaving Certificate attitude survey rotated factor loadings

Variables included in the 'Confidence in Mathematics' measure	Factor	
	1	2
Q9E Solve problems using the properties of different shapes	.626	.204
Q9I Use formulae to solve problems in measurement	.571	.237
Q9L Solve maths problems using what I have learned in more than one maths topic	.567	
Q9F Solve problems using trigonometry	.567	.266
Q9M Gather all the information available, and then use it to solve a particular maths problem	.541	.218
Q9B Find, collect and organise data	.487	
Q9K Represent this relationship in a graph	.469	
Q9D Make different shapes	.466	
Q9C Draw charts like these to display your data	.466	
Q9J Solve problems using algebra	.454	.324
Q9G Use maths to solve problems based on real-life situations	.449	
Q9H Understand indices	.442	.241
Q9A Work out the probability of something happening	.389	
Q8H I like maths	.231	.784
Q8D I enjoy learning maths	.236	.766
Q8G Maths is boring		.672
Q8F I learn things quickly in maths	.439	.606
Q8A I usually do well in maths	.389	.567
Q8E Maths is not one of my strengths	.278	.555
Q8B I would like to take more maths in school		.458
Q8C Maths is more difficult for me than many of my classmates	.321	.421
Q7G My teacher explains maths in ways that make it interesting		.296
Q7E My teacher thinks I can do well in maths	.184	.291

For both the Junior Certificate and Leaving Certificate class of 2012 survey data the first two factors are combined to produce a measure of overall confidence in mathematics. In each case the reliability of the measures was checked using Chronbach's Alpha. This statistic estimates how well the individual statements collectively measure the same underlying construct. It uses the correlations between the individual statements to estimate their consistency, how well they measure the same thing and an estimate of how likely one is to get the same result if the survey questions were repeated. Items are removed if they do not improve the robustness of the scale and the reliability analysis

repeated until all items are useful. The final value of Alpha is over 0.7 in for both Junior and Leaving Certificate surveys, the generally accepted value for a robust scale. The scales were then applied to the Autumn 2012 data and the reliability analysis repeated. The results are given in the table below, again Chronbach's Alpha well over 0.7.

Table 3: Chronbach's Alpha – 'Confidence in mathematics'

	Junior Certificate	Leaving Certificate
Class of 2012	0.903	0.894
Class of 2013	0.895	0.899
Number of items	23	23

The outcome measure confidence in mathematics is calculated by summing the 23 recoded item values for each individual. Missing values are replaced by the mean item value. It is then used in multi-level models to evaluate the impact of the revised mathematics syllabuses on attitudes towards mathematics, controlling for various background characteristics of the students.

Multi-level modelling

Multi-level modelling is a development of a common statistical technique known as 'regression analysis'. This is a technique for finding relationships between variables given the values of one or more related measures. Multi-level modelling takes account of data which is grouped into similar clusters at different levels. For example in the present study, individual students are grouped into schools. Students within a school will be more alike, on average, than students from different schools. The schools were also surveyed at two different time points, Spring and Autumn 2012; each on a different sample of students. Multi-level modelling allows us to take account of this hierarchical structure of the data and produce more reliable results. Models were fitted with three levels, school, date of survey and student and two types of outcome variable, attitudes as measured by 'Confidence in mathematics' and attainment scores.

The influence of number of strands of the revised mathematics syllabuses that the students have been exposed to is of primary interest to the study but, unfortunately, due to the structure of the evaluation this is confounded with other important variables: phase of the study, date of the survey and time of involvement in the revised mathematics syllabuses (months of study). The characteristics of the sample of students surveyed at the two time points are illustrated in Tables 4 and 5. Number of months of study is based on an approximation of 10 months' study per year.

Table 4: Characteristics of Junior Certificate students

	Non-phase one schools	Phase one schools
Class of 2012 (Spring 2012)	No strands	Strands 1-4 (27 out of 30 months)
Class of 2013 (Autumn 2012)	Strands 1-2 (21 of 30 months)	Strands 1-5 (21 out of 30 months)

Table 5: Characteristics of Leaving Certificate students

	Non-phase one schools	Phase one schools
Class of 2012 (Spring 2012)	Strands 1-2 (17 out of 20 months)	Strands 1-5 (17 out of 20 months)
Class of 2013 (Autumn 2012)	Strands 1-4 (11 out of 20 months)	Strands 1-5 (11 out of 20 months)

It is possible that the phase of involvement of the school could influence outcomes as phase one schools have been following the revised mathematics syllabuses for two years longer than the non-phase one schools and teachers will therefore have more experience of delivering it. Date of the survey could also be important as students surveyed in Spring 2012 had had six months more teaching of the revised mathematics syllabuses than those surveyed in Autumn 2012. These two variables, phase and date of survey were included in the models along with various background characteristics of the schools and students.

Attitude models

Multi-level models were fitted to the data to investigate the variation in student's confidence in their mathematical ability with phase of involvement in the revised mathematics syllabuses, the date of the survey and various background characteristics for the Junior and Leaving Certificate surveys. The results are given in Tables 6-11.

Table 6: Variables included in the Junior Certificate model

	Number of students	Minimum	Maximum	Mean	Standard deviation
Confidence in mathematics	5415	0	3	1.92	.500
Phase one (Non-phase one is base case)	5415	0	1	.146	.353
Autumn 2012 survey (Spring 2012 is base case)	5415	0	1	.49	.500
Girls (Boys are base case)	5415	0	1	.48	.500
Foundation Level (Higher Level is base case)	5415	0	1	.02	.125
Ordinary Level (Higher Level is base case)	5415	0	1	.30	.460
Vocational school (Secondary school is base case)	5415	0	1	.26	.439
Community & comprehensive school (Secondary school is base case)	5415	0	1	.15	.359

Table 7: Variables that were significant in the Junior Certificate model

		Fixed effect	Standard error	Degree of freedom	t-value	p-value
Variable names	Intercept (The predicted confidence score for the average base case)	2.085	.015	5142	137.557	.000
	Girls (Boys are base case)	-.148	.015	5142	-9.938	.000
	Foundation Level (Higher Level is base case)	-.569	.055	5142	-10.429	.000
	Ordinary Level (Higher Level is base case)	-.272	.019	5142	-14.181	.000

Table 8: The structure of the Junior Certificate model

		Variance	Standard deviation
Level	School	.004	.062
	Timing of survey (Autumn/Spring 2012)	.018	.134
	Student	.207	.455

Table 9: Variables included in the Leaving Certificate model

	Number of students	Minimum	Maximum	Mean	Standard deviation
Confidence in mathematics	4876	0	3	1.86	.493
Phase one (Non-phase one is base case)	4876	.00	1.00	1460	.35316
Autumn 2012 survey (Spring 2012 survey is base case)	4876	0	1	.53	.499
Girls (Boys are base case)	4876	0	1	.49	.500
Foundation Level (Higher Level is base case)	4876	0	1	.03	.156
Ordinary Level (Higher Level is base case)	4876	0	1	.65	.476
Vocational school (Secondary school is base case)	4876	0	1	.27	.444
Community & comprehensive school (Secondary school is base case)	4876	0	1	.16	.365

Table 10: Variables that were significant in the Leaving Certificate model

		Fixed effect	Standard error	Degree of freedom	t-value	p-value
Variable names	Intercept (The predicted confidence score for the average base case)	2.132	.019	4600	113.531	.000
	Girls (Boys are base case)	-.135	.015	4600	-9.067	.000
	Foundation Level (Higher Level is base case)	-.684	.050	4600	-13.723	.000
	Ordinary Level (Higher Level is base case)	-.296	.020	4600	-15.008	.000

Table 11: The structure of the Leaving Certificate model

		Variance	Standard deviation
Level	School	.006	.076
	Timing of survey	.012	.109
	Student	.194	.441

Attainment models

Of the booklets administered to students, only items relating to Strand 1(Statistics and Probability) and Strand 2 (Geometry and Trigonometry) were completed by both phase one and non-phase one students. It was therefore only possible to use these booklets for our impact analysis. Since the booklets were not designed to hang together as a test, it is important to explore their reliability before we considered booklet scores as outcome variables. Using an outcome with low reliability would mean much of its variability was not due to the ability of the student and may result in genuine associations being missed. Table 12 shows the reliabilities of each booklet and when combined together:

Table 12: Reliability of assessment booklets

Booklet combination	Cronbach's alpha
JC Strand 1 only (Statistics and Probability)	0.754
JC Strand 2 (Geometry and Trigonometry)	0.707
JC Strand 1 and Strand 2	0.827
LC Strand 1 (Statistics and Probability)	0.717
LC Strand 2 (Geometry and Trigonometry)	0.694
LC Strand 1 and Strand 2	0.806

Since these reliabilities were all reasonably high, we used separate booklets to explore assessment outcomes (i.e. four separate models). Multi-level models were fitted to the data to investigate the variation in attainment with phase of involvement in the revised mathematics syllabuses, the date of the survey and various background characteristics. The results are given in the tables below.

Table 13: Variables included in the Junior Certificate Strand 1 model

	Number of students	Minimum	Maximum	Mean	Standard deviation
Score on Junior Certificate Strand 1	2100	0	19	10.75	4.205
Phase one (Non-phase one is base case)	2100	0	1	.19	.391
Autumn 2012 survey (Spring 2012 survey is base case)	2100	0	1	.48	.500
Girls (Boys are base case)	2100	0	1	.52	.500
Foundation Level (Higher Level is base case)	2100	0	1	.02	.124
Ordinary Level (Higher Level is base case)	2100	0	1	.33	.469
Vocational school (Secondary school is base case)	2100	0	1	.27	.444
Community & Comprehensive school (Secondary school is base case)	2100	0	1	.14	.344

Table 14: Variables that were significant in the Junior Certificate Strand 1 model

	Fixed effect	Standard error	Degree of freedom	t-value	p-value
Intercept (The predicted confidence score for the average base case)	13.225	.247	1971	53.472	.000
Autumn 2012 (Spring 2012 is base case)	-.973	.235	48	-4.147	.000
Girls (Boys are base case)	-.722	.172	1971	-4.189	.000
Foundation Level (Higher Level is base case)	-7.080	.631	1971	-11.221	.000
Ordinary Level (Higher Level is base case)	-4.266	.227	1971	-18.759	.000
Vocational school (Secondary school is base case)	-.796	.333	75	-2.388	.019

Table 15: The structure of the Junior Certificate Strand 1 model

	Variance	Standard deviation
School	.751	.867
Timing of the survey	.938	.969
Student	9.764	3.125

Table 16: Variables included in the Junior Certificate Strand 2 model

	Number of students	Minimum	Maximum	Mean	Standard deviation
Score on Junior Certificate Strand 2	2100	0	10	5.62	2.526
Phase one (Non-phase one is base case)	210	0	1	.19	.391
Autumn 2012 (Spring 2012 is base case)	2100	0	1	.48	.500
Girls (Boys are base case)	2100	0	1	.52	.500
Foundation Level (Higher Level is base case)	2100	0	1	.02	.124
Ordinary Level (Higher Level is base case)	2100	0	1	.33	.469
Vocational school (Secondary school is base case)	2100	0	1	.27	.444
Community & Comprehensive school (Secondary school is base case)	2100	0	1	.14	.344

Table 17: Variables that were significant in the Junior Certificate Strand 2 model

	Fixed effect	Standard error	Degree of freedom	t-value	p-value
Intercept (The predicted confidence score for the average base case)	7.152	.158	1971	45.259	.000
Autumn 2012 survey (Spring 2012 survey is base case)	-.843	.167	48	-5.061	.000
Girls (Boys are base case)	-.466	.106	1971	-4.416	.000
Foundation Level (Higher Level is base case)	-3.612	.390	1971	-9.256	.000
Ordinary Level (Higher Level is base case)	-2.397	.144	1971	-16.693	.000
Vocational school (Secondary school is base case)	-.427	.207	75	-2.057	.043

Table 18: The structure of the Junior Certificate Strand 2 model

	Variance	Standard deviation
School	.156	.395
Survey time-point (Oct/Arp)	.587	.766
Student	3.649	1.910

Table 19: Variables included in the Leaving Certificate Strand 1 model

	N	Minimum	Maximum	Mean	Standard deviation
Score on Leaving Certificate Strand 1	1498	0	13	6.67	3.080
Phase one (Non-phase one is base case)	1498	0	1	.25	.436
Autumn 2012 (Spring 2012 is base case)	1498	0	1	.40	.490
Girls (Boys are base case)	1498	0	1	.52	.500
Foundation Level (Higher Level is base case)	1498	0	1	.02	.155
Ordinary Level (Higher Level is base case)	1498	0	1	.65	.477
Vocational school (Secondary school is base case)	1498	0	1	.30	.457
Community & Comprehensive school (Secondary school is base case)	1498	0	1	.15	.357

Table 20: Variables that were significant in the Leaving Certificate Strand 1 model

	Fixed effect	Standard error	Degree of freedom	t-value	p-value
Intercept (The predicted confidence score for the average base case)	8.400	.235	1365	35.811	.000
Girls (Boys are base case)	-.439	.154	1365	-2.851	.004
Foundation Level (Higher Level is base case)	-5.008	.594	1365	-8.424	.000
Ordinary Level (Higher Level is base case)	-2.186	.226	1365	-9.678	.000

Table 21: The structure of the Leaving Certificate Strand 1 model

	Variance	Standard deviation
School	1.191	1.091
Timing of survey	.552	.743
Student	5.718	2.391

Table 22: Variables included in the Leaving Certificate Strand 2 model

	Number of students	Minimum	Maximum	Mean	Standard deviation
Score on Leaving Certificate Strand 2	1495	0	14	4.58	3.038
Phase one (Non-phase one is base case)	1495	0	1	.26	.436
Autumn 2012 (Spring 2012is base case)	1495	0	1	.40	.490
Girls (Boys are base case)	1495	0	1	.52	.500
Foundation Level (Higher Level is base case)	1495	0	1	.02	.153
Ordinary Level (Higher Level is base case)	1495	0	1	.65	.476
Vocational school (Secondary school is base case)	1495	0	1	.29	.456
Community & Comprehensive school (Secondary school is base case)	1495	0	1	.15	.359

Table 23: Variables that were significant in the Leaving Certificate Strand 2 model

	Fixed effect	Standard error	Degree of freedom	t-value	p-value
Intercept (The predicted confidence score for the average base case)	7.085	.205	1363	34.559	.000
Autumn 2012 (Spring 2012 is base case)	-.778	.179	50	-4.343	.000
Foundation Level (Higher Level is base case)	-4.702	.538	1363	-8.741	.000
Ordinary Level (Higher Level is base case)	-3.242	.203	1363	-16.001	.000

Table 24: The structure of the Leaving Certificate Strand 2 model

	Variance	Standard Deviation
School	.669	.818
Timing of Survey	.440	.664
Student	5.058	2.249

Appendix B: Analysis of students' work

This appendix sets out further details of the analysis of students' work described in section 4. Tables 1 and 2 include a complete analysis of all 58 samples of students' written work. It is important to note that inference was based solely on the written product of each lesson: where homework was also included in the sample, it was not included in the analysis. This data is presented by both year group and phase.

Some samples included only the work of an individual student whereas others were a number of examples from a lesson. Each student's work was separately coded to address the varied standard sometimes present in the work from a single lesson. In some cases the samples covered a number of lessons on the same topic (labelled i*a*, i*b* etc.). Please note that where inferences have not been possible due to the sample of work provided, these have been excluded from the dataset.

Key for interpreting data in Tables 4 and 5:

- 0 = no evidence of process
- 1 = novice level process
- 2 = practitioner level process
- 3 = expert level process.

Table 1: Processes evident in students' work in phase one schools

					Mathematical process A = Problem solving B = Mastery of mathematical procedure C = Reasoning and proof D = Communication E = Connections between topics F = Representations					
Lesson number	**Year group**	**Subject level**	**Strand**	**Student sample number**	**A**	**B**	**C**	**D**	**E**	**F**
1	2nd	HL	4	i	3	3	2	2	0	2
				ii	3	3	1	0	0	1
				iii	2	2	1	0	0	1
2	2nd	HL	4	i	0	2	0	0	0	2
3	2nd	HL	4	i	2	2	0	0	0	1
4	3rd	HL	1	i	3	3	3	3	0	1
5	3rd	Mixed	3	i	0	1	1	1	0	0
				ii	0	2	1	1	0	0
6	3rd	OL	4	i	0	2	1	0	0	0
				ii	0	2	2	0	0	0
7	3rd	Mixed	4	i	2	3	0	0	0	2
				ii	2	3	0	0	0	2
				iii	1	2	0	0	0	2
8	3rd	OL	4	i	0	3	0	0	0	2
9	5th	OL	1	i	2	3	2	2	2	2
10	5th	HL	3	ia	0	3	0	0	0	0
				ib	0	3	0	0	0	0
				ic	0	3	0	0	0	0
11	5th	OL	4	i	0	1	0	1	0	0
				ii	0	1	0	1	0	0
				iii	0	2	0	1	0	0
12	6th	HL	2	i	3	3	1	1	0	0
				ii	2	3	1	1	0	0
				iii	2	3	1	1	0	0
13	6th	OL	3	i	2	2	1	1	0	2
				ii	2	2	0	0	0	1
				iii	2	2	1	1	0	2
				iv	2	2	1	1	0	2
14	6th	HL	4	i	2	3	2	2	0	2
				ii	2	2	2	2	0	1
15	6th	HL	4	ia	0	1	1	2	0	1
				ib	0	1	0	1	0	2

16	6th	OL	4	i	3	3	3	3	3	3
				ii	3	3	3	3	3	3
				iii	3	3	3	3	3	3
				iv	3	3	3	3	3	3
17	6th	HL	5	i	3	3	2	3	2	3

Table 2: Processes evident in students' work in non-phase one schools

					Mathematical process A = Problem solving B = Mastery of mathematical procedure C = Reasoning and proof D = Communication E = Connections between topics F = Representations					
Lesson number	**Year group**	**Subject level**	**Strand**	**Student sample number**	**A**	**B**	**C**	**D**	**E**	**F**
18	1st	Mixed	1	i	0	2	0	0	0	1
				ii	0	2	0	0	0	1
				iii	0	2	0	0	0	1
				iv	0	1	0	0	0	0
				v	0	2	0	0	0	1
				vi	0	2	0	0	0	1
19	1st	Mixed	1	i	0	0	0	1	0	0
20	2nd	HL	2	i	2	1	0	0	0	0
				ii	2	2	0	1	0	1
				iii	2	2	0	0	0	0
21	2nd	OL	3	i	1	0	0	0	0	1
				ii	1	1	0	0	0	1
				iii	1	1	0	0	0	1
22	3rd	HL	1	i	2	2	0	2	2	2
23	3rd	HL	1	i	1	2	0	1	0	0
24	3rd	HL	1	i	2	2	0	0	0	1
25	3rd	HL	1	i	2	3	0	0	0	1
				ii	2	3	1	1	0	1
26	3rd	HL	1	i	3	3	3	2	1	3
				ii	3	3	2	2	1	2
				iii	2	2	1	1	1	2
27	3rd	OL	1	i	3	3	0	1	0	2
				ii	2	3	0	0	0	2
				iii	2	3	0	0	0	2
28	3rd	OL	1	i	0	1	0	0	0	1

				ii	0	1	0	0	0	1
				iii	0	1	0	0	0	0
				iv	0	2	2	1	0	0
29	3rd	OL	2	i	2	3	0	0	0	0
				ii	2	3	0	1	0	0
				iii	1	2	0	1	0	0
30	3rd	OL	2	i	1	2	1	1	2	1
				ii	1	2	2	1	2	1
				iii	1	2	2	1	2	1
31	3rd	OL	2	i	1	1	1	1	0	0
				ii	1	1	1	1	0	0
				iii	1	2	1	2	0	0
				iv	1	2	1	1	0	0
				v	1	2	1	1	0	1
				vi	1	3	1	1	0	0
32	3rd	OL	2	i	0	2	0	0	0	1
				ii	0	2	0	0	0	1
				iii	0	1	0	0	0	1
				iv	0	2	0	0	0	1
33	3rd	HL	2	i	0	3	0	0	0	0
34	3rd	HL	2	i	0	3	0	0	0	0
35	3rd	HL	2	i	2	3	0	2	1	2
				ii	2	3	0	2	1	2
				iii	2	3	0	2	1	2
				iv	3	3	1	2	1	3
				v	2	3	1	2	1	2
36	3rd	OL/FL	2	i	2	1	2	0	0	1
37	3rd	HL	2	i	0	2	0	3	0	2
				ii	0	2	0	3	0	2
				iii	0	2	0	3	0	2
38	3rd	OL	4	i	0	3	0	0	0	0
				ii	0	3	0	0	0	0
				iii	0	3	0	0	0	0
39	3rd	HL	4	i	0	3	0	0	0	0
				ii	0	2	0	0	0	0
				iii	0	3	0	0	0	0
40	5th	OL	1	i	2	3	0	0	0	2
				ii	3	3	0	0	0	2
41	5th	HL	4	i	1	1	0	0	0	1
				ii	1	2	0	1	0	0
				iii	1	1	0	1	0	0
				iv	2	2	1	2	0	1
				v	1	2	1	2	0	1
				vi	1	2	1	2	0	1
				vii	1	2	1	1	0	1

42	5th	HL	4	i	0	3	0	0	0	0
				ii	0	2	0	0	1	0
				iii	0	2	0	0	1	0
43	5th	OL	4	i	2	2	2	2	0	2
				ii	2	3	3	2	0	2
				iii	1	1	0	0	0	1
44	5th	HL	5	i	1	2	0	1	0	1
				ii	1	2	0	1	0	1
45	6th	OL	1	i	2	2	1	1	0	1
				ii	2	2	2	1	0	1
				iii	2	2	1	1	0	1
				iv	2	2	1	2	0	1
				v	2	2	1	1	0	1
46	6th	OL	1	i	2	2	1	1	0	1
				ii	2	1	1	1	0	1
				iii	2	1	1	1	0	1
				iv	2	1	1	1	0	1
47	6th	OL	1	i	2	2	1	1	0	0
				ii	2	2	1	1	0	0
				iii	2	2	1	0	0	0
48	6th	HL	2	i	2	1	1	0	0	2
49	6th	HL	2	i	2	2	2	0	0	0
50	6th	HL	2	i	2	3	0	0	0	1
51	6th	OL	2	i	1	2	2	1	0	1
				ii	1	1	2	1	0	1
				iii	1	2	2	1	0	1
52	6th	OL	3	i	2	3	0	0	2	2
				ii	2	3	0	0	2	2
				iii	2	3	0	0	2	2
53	6th	OL	3	i	2	3	0	0	0	0
54	6th	OL	3	i	2	3	0	0	0	0
55	6th	HL	3	i	3	3	3	2	2	3
				ii	1	1	0	0	0	0
				iii	3	3	3	3	2	3
				iv	3	3	3	3	2	2
				v	3	3	3	3	2	2
				vi	3	3	3	3	2	2
56	6th	OL	4	i	2	3	1	0	0	1
				ii	2	3	1	1	0	0
				iii	2	3	2	1	0	0
				iv	2	3	2	1	0	0
				v	2	3	1	1	0	0
57	6th	HL	5	i	2	2	1	1	0	1
				ii	2	3	2	1	0	2

				iii	2	3	0	1	0	1
58	6th	FL	5	I	2	1	0	0	0	1
				ii	2	1	0	0	0	1

Appendix C: Data tables for the student attitude survey

This appendix sets out the findings of the student attitude survey for the class of 2013. Data for the class of 2012 is set out in full in NFER's interim report to NCCA (November 2012).

How often do you do these things in your mathematics lessons?

Table 1: We show our working to justify our answers

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Often	85	84	76	84
Sometimes	10	12	18	13
Rarely	2	2	3	2
Never	1	1	1	1
No response	2	1	2	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 2: We think about maths problems and plan how to solve them

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Often	61	56	44	51
Sometimes	27	32	37	34
Rarely	9	8	13	12
Never	2	2	5	3
No response	1	1	2	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 3: We make links between different maths topics

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Often	33	21	28	24
Sometimes	40	48	41	46
Rarely	20	22	23	22
Never	5	8	6	7
No response	2	2	1	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 4: We apply what we learn in maths to real life situations

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Often	19	15	13	9
Sometimes	51	47	37	40
Rarely	24	29	37	37
Never	4	8	12	13
No response	1	1	1	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 5: We do investigations to solve maths problems

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Often	33	36	19	21
Sometimes	34	34	39	35
Rarely	20	20	27	29
Never	10	9	14	14
No response	4	2	1	2
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 6: We talk about our ideas using the language of maths

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Often	24	22	22	16
Sometimes	38	39	33	35
Rarely	25	25	30	30
Never	10	13	13	17
No response	2	2	2	2
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 7: We work together in small groups or pairs

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Often	16	8	27	8
Sometimes	20	19	21	19
Rarely	31	36	25	30
Never	32	34	26	42
No response	1	1	2	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 8: We use computers in maths lessons to help us solve problems

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Often	9	4	6	4
Sometimes	11	10	15	10
Rarely	23	23	17	19
Never	56	61	61	66
No response	1	1	2	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 9: We use text books in lessons then practise what we have learned in class and/or for homework

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Often	74	84	74	89
Sometimes	12	10	15	7
Rarely	5	3	5	2
Never	6	1	4	1
No response	4	1	1	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 10: We copy what our teacher writes on the board then practice using examples

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Often	74	76	66	76
Sometimes	18	18	23	19
Rarely	6	3	8	4
Never	<1	1	2	1
No response	1	1	1	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 11: We practise exam questions in class

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Often	22	28	23	26
Sometimes	33	34	34	39
Rarely	25	20	25	21
Never	18	16	15	12
No response	1	1	2	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

How much do you agree with these statements about your mathematics lessons?

Table 12: My teacher gives me work that will challenge me to improve my skills

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Agree a lot	64	61	54	55
Agree a little	31	32	35	37
Disagree a little	4	5	6	6
Disagree a lot	1	2	2	2
No response	1	<1	3	<1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 13: My teacher thinks I can do well in maths

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Agree a lot	56	57	44	50
Agree a little	36	33	41	38
Disagree a little	5	6	9	9
Disagree a lot	1	3	2	2
No response	2	1	5	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 14: I know what my teacher expects me to do

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Agree a lot	65	61	54	59
Agree a little	25	29	31	32
Disagree a little	7	7	10	6
Disagree a lot	1	2	2	2
No response	2	1	2	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 15: My teacher helps me to understand if I am finding something difficult during a maths lesson

	Junior Certificate Phase one	Junior Certificate Non-phase one	Leaving Certificate Phase one	Leaving Certificate Non-phase one
	%	%	%	%
Agree a lot	68	67	64	69
Agree a little	22	22	21	20
Disagree a little	8	7	9	6
Disagree a lot	1	3	2	3
No response	2	<1	3	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 16: My teacher is easy to understand

	Junior Certificate Phase one	Junior Certificate Non-phase one	Leaving Certificate Phase one	Leaving Certificate Non-phase one
	%	%	%	%
Agree a lot	55	50	52	54
Agree a little	31	30	28	30
Disagree a little	10	13	13	10
Disagree a lot	2	7	5	5
No response	1	1	3	<1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table17: My teacher explains maths in ways that make it interesting

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Agree a lot	31	27	26	23
Agree a little	41	36	31	40
Disagree a little	19	22	27	24
Disagree a lot	8	15	13	13
No response	1	<1	3	<1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 18: My teacher sets me work to suit my abilities and interests

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Agree a lot	19	22	14	15
Agree a little	43	40	41	38
Disagree a little	22	24	23	26
Disagree a lot	14	13	20	20
No response	1	1	2	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 19: My teacher will decide if I should do Foundation Level, Ordinary Level or Higher Level

	Junior Certificate Phase one	Junior Certificate Non-phase one	Leaving Certificate Phase one	Leaving Certificate Non-phase one
	%	%	%	%
Agree a lot	19	27	9	11
Agree a little	33	32	23	22
Disagree a little	31	22	27	26
Disagree a lot	15	19	38	40
No response	1	1	4	<1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 20: The way we learn maths at Junior Certificate level is harder than maths in primary school

	Junior Certificate Phase one	Junior Certificate Non-phase one
	%	%
Often	64	69
Sometimes	24	21
Rarely	6	5
Never	4	3
No response	2	1
Total %	100	100
N =	417	2248

Due to rounding, percentages may not sum to 100.

NFER student survey, Autumn 2012

Table 21: The way we learn maths at Leaving Certificate Level is the same as how we learned maths for the Junior Certificate

	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Often	14	19
Sometimes	31	35
Rarely	30	26
Never	23	20
No response	2	1
Total %	100	100
N =	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

How much do you agree with these statements about learning mathematics?

Table 22: I usually do well in maths

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Agree a lot	32	31	23	21
Agree a little	46	47	46	49
Disagree a little	17	15	21	20
Disagree a lot	4	6	8	9
No response	1	<1	2	<1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 23: I would like to take more maths in school

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Agree a lot	18	18	16	17
Agree a little	27	30	31	28
Disagree a little	32	29	24	27
Disagree a lot	22	23	27	28
No response	1	1	2	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 24: Maths is more difficult for me than many of my classmates

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Agree a lot	11	13	14	13
Agree a little	24	25	24	27
Disagree a little	36	36	38	37
Disagree a lot	27	25	21	23
No response	2	1	3	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 25: I enjoy learning maths

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Agree a lot	24	23	20	19
Agree a little	41	37	32	38
Disagree a little	22	23	23	23
Disagree a lot	12	16	22	20
No response	1	1	2	<1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 26: Maths is not one of my strengths

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Agree a lot	29	28	34	33
Agree a little	21	24	23	25
Disagree a little	27	27	22	26
Disagree a lot	22	21	19	15
No response	2	1	2	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 27: I learn things quickly in maths

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Agree a lot	21	19	15	16
Agree a little	42	41	33	37
Disagree a little	26	27	33	32
Disagree a lot	10	12	16	14
No response	2	1	2	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 28: Maths is boring

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Agree a lot	15	20	21	21
Agree a little	27	28	26	26
Disagree a little	35	29	29	32
Disagree a lot	22	21	22	20
No response	1	1	2	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 29: I like maths

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Agree a lot	25	24	21	19
Agree a little	39	37	35	37
Disagree a little	20	22	22	22
Disagree a lot	14	17	19	21
No response	1	1	2	<1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

How confident do you feel when doing the following types of activities during mathematics lessons?

Table 30: If I were asked to work out the probability of something happening

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
I would find it very easy	58	52	43	43
I would find it easy	34	33	38	35
I would find it a little difficult	6	11	11	18
I would find it very difficult	<1	2	3	4
No response	1	1	4	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 31: If I were asked to draw charts like these to display your data

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
I would find it very easy	48	48	55	57
I would find it easy	42	38	35	35
I would find it a little difficult	7	13	5	6
I would find it very difficult	1	1	1	1
No response	1	<1	4	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 32: If I were asked to make different shapes

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
I would find it very easy	66	66	60	68
I would find it easy	28	24	24	24
I would find it a little difficult	3	7	9	6
I would find it very difficult	<1	2	1	1
No response	2	1	5	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 33: If I were asked to solve problems using the properties of different shapes

	Junior Certificate Phase one	Junior Certificate Non-phase one	Leaving Certificate Phase one	Leaving Certificate Non-phase one
	%	%	%	%
I would find it very easy	20	15	24	28
I would find it easy	40	36	32	36
I would find it a little difficult	35	41	33	30
I would find it very difficult	4	8	7	5
No response	1	<1	3	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 34: If I were asked to solve problems using trigonometry

	Junior Certificate Phase one	Junior Certificate Non-phase one	Leaving Certificate Phase one	Leaving Certificate Non-phase one
	%	%	%	%
I would find it very easy	21	24	28	33
I would find it easy	35	36	30	31
I would find it a little difficult	32	31	29	27
I would find it very difficult	10	9	10	8
No response	2	1	3	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 35: If I were asked to use formulae to solve problems in measurement

	Junior Certificate Phase one	Junior Certificate Non-phase one	Leaving Certificate Phase one	Leaving Certificate Non-phase one
	%	%	%	%
I would find it very easy	20	22	19	25
I would find it easy	38	36	31	37
I would find it a little difficult	32	33	35	29
I would find it very difficult	8	8	11	8
No response	2	1	4	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 36: If I were asked to solve problems using algebra

	Junior Certificate Phase one	Junior Certificate Non-phase one	Leaving Certificate Phase one	Leaving Certificate Non-phase one
	%	%	%	%
I would find it very easy	30	31	32	40
I would find it easy	35	34	33	33
I would find it a little difficult	23	25	20	19
I would find it very difficult	10	9	11	8
No response	2	1	4	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 37: If I were asked to represent this relationship in a graph

	Junior Certificate Phase one	Junior Certificate Non-phase one	Leaving Certificate Phase one	Leaving Certificate Non-phase one
	%	%	%	%
I would find it very easy	53	43	57	58
I would find it easy	35	37	30	31
I would find it a little difficult	10	16	8	9
I would find it very difficult	1	3	1	2
No response	2	1	4	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 38: If I were asked to use maths to solve problems based on real-life situations

	Junior Certificate Phase one	Junior Certificate Non-phase one	Leaving Certificate Phase one	Leaving Certificate Non-phase one
	%	%	%	%
I would find it very easy	27	36	27	34
I would find it easy	48	45	45	43
I would find it a little difficult	20	16	20	19
I would find it very difficult	4	3	4	4
No response	1	<1	4	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 39: If I were asked to solve maths problems using what I have learned in more than one maths topic

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
I would find it very easy	19	21	17	20
I would find it easy	47	42	40	40
I would find it a little difficult	29	31	33	34
I would find it very difficult	4	5	6	4
No response	2	1	4	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 40: If I were asked to gather all the information available, and then use it to solve a particular maths problem

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
I would find it very easy	14	18	13	16
I would find it easy	49	47	39	42
I would find it a little difficult	30	29	38	36
I would find it very difficult	5	5	6	5
No response	2	1	5	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

How much do you agree with these statements about mathematics?

Table 41: I think learning maths will help me in my daily life

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Agree a lot	37	40	18	21
Agree a little	42	40	44	45
Disagree a little	14	14	22	22
Disagree a lot	5	5	12	11
No response	1	1	4	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 42: I need maths to learn other school subjects

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Agree a lot	22	25	16	14
Agree a little	50	46	30	35
Disagree a little	21	21	28	32
Disagree a lot	6	8	22	19
No response	1	1	4	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 43: I need to do well in maths to get into the university of my choice

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Agree a lot	62	61	36	38
Agree a little	27	28	30	32
Disagree a little	8	7	19	17
Disagree a lot	1	3	12	12
No response	2	1	4	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 44: I need to do well in maths to get the job I want

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Agree a lot	50	48	19	23
Agree a little	30	31	29	31
Disagree a little	13	14	27	26
Disagree a lot	4	6	20	19
No response	2	1	5	1
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 45: Please tick the box that best describes the further study you plan to do after finishing your Leaving Certificate?

	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
University, doing a course that will involve a lot of maths	13	13
University, doing a course that will involve some maths	30	31
A technical or vocational course that will involve maths	3	5
University, doing a course that won't involve maths	40	39
Other	10	8
No response	4	4
Total %	100	100
N =	360	1976

Due to rounding, percentages may not sum to 100.

A filter question: all those who answered [Q13A=1].

Source: NFER student survey, Autumn 2012

Table 46: Are you currently planning to stay on at school after your Junior Certificate?

	Junior Certificate phase one %	Junior Certificate Non-phase one %
Yes	96	94
No	1	3
No response	3	3
Total %	100	100
N =	417	2248

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 47: If yes, at what level would you like to take your maths Leaving Certificate examination?

	Junior Certificate Phase one	Junior Certificate Non-phase one
	%	%
Foundation Level	<1	1
Ordinary Level	19	33
Higher Level	80	65
No response	1	1
Total %	100	100
N =	399	2118

Due to rounding, percentages may not sum to 100.

A filter question: all those who answered [Q11A=1].

Source: NFER student survey, Autumn 2012

Which of these jobs do you think involve doing mathematics?

Table 48: Engineer

	Junior Certificate Phase one	Junior Certificate Non-phase one	Leaving Certificate Phase one	Leaving Certificate Non-phase one
	%	%	%	%
Yes	88	88	90	95
No	9	10	5	3
No response	3	2	5	2
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 49: Doctor

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Yes	59	58	60	56
No	37	37	35	40
No response	4	5	5	4
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 50: Sales assistant

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Yes	89	91	83	86
No	8	7	12	11
No response	3	2	5	2
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 51: Scientist

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Yes	89	87	85	89
No	8	10	10	9
No response	3	3	5	3
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 52: Working with technology

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Yes	87	82	83	87
No	11	14	12	11
No response	3	4	5	2
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 53: Accountant

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Yes	95	95	91	95
No	3	3	5	3
No response	2	2	5	2
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 54: Nurse

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Yes	39	39	41	40
No	57	55	53	56
No response	4	6	6	4
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 55: Fashion Designer

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Yes	48	50	44	45
No	48	45	50	51
No response	4	5	6	4
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 56: Owning my own business

	Junior Certificate Phase one %	Junior Certificate Non-phase one %	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Yes	97	95	92	95
No	1	3	3	4
No response	2	2	5	2
Total %	100	100	100	100
N =	417	2248	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Table 57: Are you currently thinking of doing a job that involves maths?

	Leaving Certificate Phase one %	Leaving Certificate Non-phase one %
Yes	32	32
No	60	65
No response	8	3
Total %	100	100
N =	413	2161

Due to rounding, percentages may not sum to 100.

Source: NFER student survey, Autumn 2012

Appendix D: Students' performance in relation to individual strands of the revised mathematics curriculum

This appendix sets out the details of students' performance in relation to individual strands of the revised curriculum, comparing students' attainment and attitudes in the class of 2013 to the class of 2012. Data for the class of 2012 is set out in full in NFER's interim report to NCCA (November 2012).

Overview of students' performance in each strand of the revised syllabuses

Tables 1 and 2 provide a comparison of Junior Certificate and Leaving Certificate students' performance in the assessment phase of the research. It includes comparison between phase of study (phase one and non-phase one) and year group (class of 2012 and class of 2013). For reference, the booklet labels correspond to the following strands:

- **JC 1/2/5**: Junior Certificate Strands 1, 2 and 5
- **JC 3/4/5**: Junior Certificate Strands 3, 4 and 5
- **LC 1/2/5**: Leaving Certificate Strands 1, 2 and 5 (in Spring 2012 Strands 1 and 2 were referred to as SPLC1 and GTLC2 respectively)
- **LC 3/4/5**: Leaving Certificate Strands 3, 4 and 5 (in Spring 2012, booklets were referred to as NLC3 (Strand 3), ALC4 (Strand 4) and FLC5 (Strand 5).

Coloured shading highlights items where performance has changed. Pale green denotes an *increase* of 6-10 percentage points inclusive, while darker green shading is used for increases over 10 percentage points. Pale and dark orange shading is used for *decreases* of the same magnitude.

Table 1: Comparison of Junior Certificate students' performance

Booklet	Item	Syllabus area assessed	Phase one students Class of 2012		Phase one students Class of 2013		Non-phase one students Class of 2012		Non-phase one students Class of 2013	
			Facility (%)	% Omit	Facility (%)	% Omit	Facility (%)	% Omit	Facility (%)	% Omit
JC1/2/5	1	1.2	87	1	89	0	87	0	86	1
	2	1.7	96	0	98	0	95	1	93	1
	3	1.6	≥1m: 68 2m: 62	3	≥1m: 71 2m: 65	2	≥1m: 68 2m: 60	4	≥1m: 60 2m: 54	4
	4	1.3	86	1	84	0	76	1	78	1
	5	1.6	95	1	97	0	94	1	90	2
	6a	1.7	≥1m: 64 2m: 47	14	≥1m: 65 2m: 42	11	≥1m: 61 2m: 40	17	≥1m: 52 2m: 32	19
	6b	1.7	≥1m: 57 2m: 33	17	≥1m: 54 2m: 29	12	≥1m: 55 2m: 28	17	≥1m: 46 2m: 20	21
	6c	1.7	47	16	60	13	47	17	44	18
	7a	1.6	73	2	69	1	74	1	53	2
	7b	1.7	≥1m: 76 2m: 41	1	≥1m: 77 2m: 47	0	≥1m: 74 2m: 37	1	≥1m: 68 2m: 32	2
	8	1.3	71	1	68	3	70	2	65	3
	9	1.4	22	2	23	9	19	3	18	6
	10	1.3	60	5	70	4	52	10	54	10
	11	1.4	≥1m: 54 2m: 17	10	≥1m: 56 2m: 20	8	≥1m: 45 2m: 13	12	≥1m: 41 2m: 17	13
	12	2.3	87	2	82	2	82	2	73	5
	13	2.1	59	4	55	4	52	3	43	4
	14	2.1	67	3	67	5	59	4	58	5
	15	2.1	64	5	71	5	68	4	62	4
	16	2.1	37	4	28	6	40	4	34	5
	17	2.2	76	4	82	3	81	4	74	4
	18	2.3	73	4	64	5	65	5	57	8
	19	2.1	51	19	54	13	46	17	38	24
	20	2.1	35	14	36	10	41	15	26	21
	21	2.1	65	5	55	8	56	8	44	15
JC3/4/5	1	3.1	77	1	81	0	-	-	-	-
	2	3.2	90	0	95	0	-	-	-	-
	3	3.1	69	2	67	0	-	-	-	-
	4	3.1	50	9	49	8	-	-	-	-
	5	3.4	83	1	88	1	-	-	-	-

	6	3.1	72	2	80	0	-	-	-	-
	7	3.1	59	2	63	3	-	-	-	-
	8	3.4	3	11	2	7	-	-	-	-
	9	3.4	93	2	95	1	-	-	-	-
	10a	3.3	74	3	90	0	-	-	-	-
	10b	3.3	34	11	40	5	-	-	-	-
	11	3.1	10	3	8	1	-	-	-	-
	12	4.2	≥1m: 29 2m: 17	8	≥1m: 30 2m: 19	7	-	-	-	-
	13a	4.2	≥1m: 74 2m: 66	2	≥1m: 75 2m: 63	1	-	-	-	-
	13b	4.7	29	37	26	26	-	-	-	-
	13c	4.4	≥1m: 21 2m: 9	31	≥1m: 26 2m: 8	16	-	-	-	-
	14	4.5	14	18	19	17	-	-	-	-
	15	4.7	38	4	37	5	-	-	-	-
	16	4.6	73	4	73	3	-	-	-	-
	17	4.3	65	4	63	3	-	-	-	-
	18	4.6	54	5	53	4	-	-	-	-
	19	4.7	57	4	53	8	-	-	-	-
	20	4.4	36	5	30	8	-	-	-	-
	21	4.3	46	5	45	8	-	-	-	-
JC1/2/5	22	5.2	-	-	56	9	-	-	-	-
& JC3/4/5	23	5.2	-	-	23	14	-	-	-	-

Table 2: Comparison of Leaving Certificate students' performance

Class of 2012 booklet	Item	Class of 2013 booklet	Item	Syllabus area assessed	Phase one students Class of 2012		Phase one students Class of 2013		Non-phase one students Class of 2012		Non-phase one students Class of 2013	
					Facility (%)	% Omit	Facility (%)	% Omit	Facility (%)	% Omit	Facility (%)	% Omit
SPLC1	1	**LC1/2/5**	1	1.2	61	2	67	0	62	2	60	2
	2		2	1.2	67	3	67	1	62	3	60	3
	3		3	1.4	≥1m: 58 2m: 28	3	≥1m: 53 2m: 21	4	≥1m: 51 2m: 21	7	≥1m: 47 2m: 19	7
	4		4	1.3	70	2	66	3	61	5	59	4
	5		5	1.6	66	3	63	2	56	7	57	5
	6		6	1.4	1	2	1	0	1	4	1	2
	7a		7a	1.6	80	2	84	1	75	6	78	3
	7b		7b		≥1m: 79 2m: 42	2	≥1m: 82 2m: 47	0	≥1m: 73 2m: 39	7	≥1m: 76 2m: 39	2
	8		8	1.4	≥1m: 63 2m: 58	8	≥1m: 66 2m: 60	3	≥1m: 58 2m: 49	18	≥1m: 58 2m: 48	11
	9		9	1.4	49	17	58	6	38	25	46	20
GTLC2	1	**LC1/2/5**	10	2.1	59	4	62	4	48	3	48	7
	2a		11a	2.1	77	5	75	3	68	6	61	14
	2b		11b		≥1m: 20 2m: 18	49	≥1m: 20 2m: 17	42	≥1m: 13 2m: 10	53	≥1m: 16 2m: 15	54
	3		12	2.1	51	2	48	1	47	2	40	8
	4		13	2.1	67	5	73	3	68	4	62	9
	5		14	2.1	28	9	32	4	28	6	23	14
	6		15	2.2	34	8	33	6	41	9	24	19
	7		16	2.2	17	9	12	12	18	16	6	30
	8a		17a	2.3	31	19	28	22	25	19	18	32
	8b		17b		13	50	18	47	14	50	11	68
	9		18	2.2	≥1m: 30 2m: 22	31	≥1m: 32 2m: 27	26	≥1m: 36 2m: 30	32	≥1m: 18 2m: 14	51
	10a		19a	2.3	12	27	19	33	18	29	17	41
	10b		19b		≥1m: 11 2m: 1	70	≥1m: 12 2m: 0	75	≥1m: 13 2m: 0	70	≥1m: 7 2m: 0	81
NLC3	1	**LC3/4/5**	1	3.4	82	5	71	1	-	-	69	4
	2		2	3.1	29	13	23	15	-	-	17	21
	3		3	3.4	42	3	50	1	-	-	38	3
	4		4	3.4	≥1m: 47 2m: 14	2	≥1m: 50 2m: 24	4	-	-	≥1m: 48 2m: 15	3
	5		5	3.5	71	4	77	1	-	-	62	3
	6		6	3.1	35	6	40	4	-	-	32	7
	7		7	3.1	18	14	17	17	-	-	12	16
	8a		8a	3.1	59	7	68	1	-	-	61	5
	8b		8b		≥1m: 36 2m: 25	24	≥1m: 39 2m: 30	9	-	-	≥1m: 30 2m: 22	17

	9		9	3.4	23	9	23	1	-	-	25	5
	10		10	3.1	14	61	0	44	-	-	1	60
ALC4	1a	**LC3/4/5**	11a	4.1	82	2	86	2	-	-	81	6
	1b		11b		25	12	35	8	-	-	21	18
	2a		12a	4.1	≥1m: 84 2m: 76	9	≥1m: 69 2m: 65	14	-	-	≥1m: 58 2m: 53	28
	2b		12b		≥1m: 47 2m: 34	17	≥1m: 51 2m: 23	20	-	-	≥1m: 39 2m: 17	38
	3		13	4.4	13	10	10	16	-	-	14	19
	4		14	4.3	26	10	28	18	-	-	12	28
	5		15	4.3	8	19	6	19	-	-	2	38
	6		16	4.1	16	11	12	22	-	-	11	34
	7		17	4.2	5	38	7	43	-	-	2	64
FLC5	1	**LC1/2/5**	20 / 18	5.1	34	3	33	13	-	-	-	-
	2	**&**	21 / 19	5.2	9	12	7	22	-	-	-	-
	3	**LC3/4/5**	22 / 20	5.1	77	3	56	15	-	-	-	-
	4a		23a / 21a	5.2	2	34	2	52	-	-	-	-
	4b		23a / 21b		1	46	0	59	-	-	-	-
	5		24 / 22	5.2	3	33	3	59	-	-	-	-
	6		25 / 23	5.1	21	10	17	30	-	-	-	-
	7a		26a / 24a	5.2	15	35	5	60	-	-	-	-
	7b		26a / 24b		2	46	1	71	-	-	-	-
	8		27 / 25	5.2	28	17	20	43	-	-	-	-
	9		28 / 26	5.2	24	16	14	44	-	-	-	-

Strand 1: Statistics and Probability

Strand 1, Statistics and Probability, was one of the first to be introduced in schools and is therefore well established. All students involved in the research had followed Strand 1 of the revised curriculum.

Junior and Leaving Certificate students were assessed against a number of items relating to Strand 1 of the revised mathematics syllabuses. These included: 'concepts of probability' (1.2), 'outcomes of random processes' (1.3), 'statistical reasoning with an aim to becoming a statistically aware consumer' (1.4), and 'representing data graphically and numerically' (1.6). Junior Certificate students were also assessed on 'analysing, interpreting and drawing conclusions from data' (1.7).

Junior Certificate

A total of 211 students from phase one schools and 795 students from non-phase one schools completed the items assessing Strand 1 of the revised mathematics syllabuses. Their performance is shown in Table 3.

In this and the following tables, the proportion of students who achieved just one mark, and the proportion who received full credit, for all two mark items is presented. For each item, the tables also give the broad syllabus area assessed and a summary of the task.

The performance of the class of 2013 is broadly similar to the class of 2012. Items 2 and 5 remain the easiest within this strand and none of the items have proven to be overly difficult (facility <20 per cent). Students continue to show a strong performance on items assessing this strand.

Table 3: Junior Certificate students' performance in items relating to Strand 1 of the revised mathematics syllabuses

JC1/2/5 Item	Syllabus area	Item summary	Phase one students		Non-phase one students	
			1 mark (%)	2 marks (%)	1 mark (%)	2 marks (%)
1	Probability	Estimate and compare probabilities (numbered tickets)	89		86	
2	Interpreting data	Interpret data (bar chart)	98		93	
3	Representing data	Transform data (pie chart to bar chart)	6	65	5	54
4	Probability	Estimate probability (coloured marbles)	84		78	
5	Representing data	Match tabulated data to corresponding line graph	97		90	
6a	Interpreting data	Use bus timetables to plan travel according to time constraints	23	42	20	32
6b	Interpreting data	Use bus timetables to plan travel according to time constraints	25	29	26	20
6c	Interpreting data	Draw conclusions from tabulated data	60		44	
7a	Representing data	Find and compare means from tabulated data	69		53	
7b	Interpreting data	Draw conclusions from data in scatter graph	30	47	36	32
8	Probability	Find number of coloured beads (from probability of selection)	68		65	
9	Statistical reasoning	Understand how data points relate to their average	23		18	
10	Probability	Estimate size of sectors on coloured spinner (from experimental data)	70		54	
11	Statistical reasoning	Recognise that a graph is potentially misleading	36	20	24	17

Leaving Certificate

A total of 203 students from phase one schools and 393 students from non-phase one schools completed the items assessing Strand 1 of the revised syllabuses. Their performance is shown in Table 4. The table shows that students are performing well on all but item 6. The performance of the class of 2013 is broadly similar to the class of 2012.

Table 4: Leaving Certificate students' performance in items relating to Strand 1 of the revised mathematics syllabuses

LC1/2/5 Item	Syllabus area	Item summary	Phase one students		Non-phase one students	
			1 mark (%)	2 marks (%)	1 mark (%)	2 marks (%)
1	Probability	Estimate probability of two independent events	67		60	
2	Probability	Interpret long-term probability of earthquake	67		60	
3	Statistical Reasoning	Recognise graph as potentially misleading	33	21	28	19
4	Probability	Estimate size of sectors on coloured spinner (from experimental data)	66		59	
5	Representing Data	Understand why bar graph is unsuitable for given data	63		57	
6	Statistical reasoning	Understand how data points relate to their average	1		1	
7a	Representing Data	Calculate and compare means from tabulated data	84		78	
7b	Representing Data	Draw conclusions from data in graphical form	34	47	37	39
8	Statistical reasoning	Compare quality of polls based on sampling methods	5	60	10	48
9	Statistical reasoning	Use graph to make mathematical argument	58		46	

Strand 2: Geometry and Trigonometry

Strand 2, Geometry and Trigonometry, was one of the first strands to be introduced in schools and is therefore well established. All students involved in this research had experience of this strand of the revised curriculum.

Junior and Leaving Certificate students were assessed against a number of items relating to Strand 2 of the revised mathematics syllabuses. For Leaving Certificate students, these included 'synthetic geometry' (2.1), 'co-ordinate geometry' (2.2), and 'trigonometry' (2.3). For Junior Certificate students, these included: 'synthetic geometry' (2.1), 'transformation geometry' (2.2) and 'co-ordinate geometry' (2.3).

Junior Certificate

A total of 211 students from phase one schools and 795 students from non-phase one schools completed the items assessing Strand 2 of the revised syllabuses. Their performance is shown in Table 5. The table shows that none of the items are particularly easy or difficult. Students' performance in the items is similar to the class of 2012.

Table 5: Junior Certificate students' performance in items relating to Strand 2 of the revised mathematics syllabuses

JC1/2/5 Item	Syllabus area	Item summary	Phase one students		Non-phase one students	
			1 mark (%)	2 marks (%)	1 mark (%)	2 marks (%)
12	Coordinate geometry	Identify a point given coordinates	82		73	
13	Synthetic geometry	Find size of angle (using congruent triangles & sum to 180)	55		43	
14	Synthetic geometry	Find size of angle formed by diagonals of hexagon	67		58	
15	Synthetic geometry	Find size of angle (using straight angle)	71		62	
16	Synthetic geometry	Find size of angle (using vertically opposite angles & isosceles triangle)	28		34	
17	Transformation geometry	Rotate 3-D shape	82		74	
18	Coordinate geometry	Identify coordinates of top vertex of isosceles triangle	64		57	
19	Synthetic geometry	Construct obtuse & acute angles	54		38	
20	Synthetic geometry	Find size of angle (using bisectors & straight angle)	36		26	
21	Synthetic geometry	Find size of angles (using alternate angles or exterior angle)	55		44	

Leaving Certificate

A total of 203 students from phase one schools and 393 students from non-phase one schools completed the items assessing Strand 2 of the revised syllabuses. Their performance is shown in Table 6. In general, performance is similar to the class of 2012 with students finding the same items (2b, 7, 8b, 9, 10a and 10b) particularly difficult. Additionally, students from non-phase one schools achieved low scores on item 8a. The item was also quite difficult for the class of 2012 and it is likely that the further reduction in facility is due to the differences in the time of year that the trial took place (the class of 2013 had less schooling than the class of 2012).

Table 6: Leaving Certificate students' performance in items relating to Strand 2 of the revised mathematics syllabuses

LC1/2/5 Item	Syllabus area	Item summary	Phase one students		Non-phase one students	
			1 mark (%)	2 marks (%)	1 mark (%)	2 marks (%)
1	Synthetic Geometry	Match complex description of shapes to diagram	62		48	
2a	Synthetic Geometry	Size of angle formed by diagonals of hexagon	75		61	
2b		Show working for 2a	2	17	1	15
3	Synthetic Geometry	Size of angle (sum to 180; vertically opposite angles)	48		40	
4	Synthetic Geometry	Size of angles (alternate angles; exterior angle theorem)	73		62	
5	Synthetic Geometry	Length of median of isosceles triangle	32		23	
6	Coordinate Geometry	Sum of slopes of equilateral triangle	33		24	
7	Coordinate Geometry	Investigate whether two lines are parallel	12		6	
8a	Trigonometry	Solve for x given value of sin 2x	28		18	
8b		Show working for 8a	18		11	
9	Coordinate Geometry	Prove two lines intersect at a common midpoint (diagonals of parallelogram)	4	27	4	14
10a	Trigonometry	Find the length of a chord of a circle (width of window in semi-circular room)	19		17	
10b		Show working for 10a	12	0	7	0

Strand 3: Number

All students in phase one schools had studied Strand 3 (Number). In non-phase one schools, just Leaving Certificate students had studied this strand.

Junior and Leaving Certificate students were assessed against a number of items relating to Strand 3 of the revised mathematics syllabuses. For Leaving Certificate students, these included: 'number systems' (3.1), 'length, area and volume (3.4)', and 'synthesis and problem solving skills' (3.5). For Junior Certificate students, these also included: 'indices' (3.2), 'applied arithmetic' (3.3) and 'applied measure' (3.4).

Junior Certificate

A total of 210 students from phase one schools completed the items assessing Strand 3 (Number). Performance in Strand 3 is shown in Table 7 below. The broad pattern of performance is similar to that of the class of 2012 with items 2 and 9 proving to be very easy for students and items 8 and 11 being particularly difficult.

Table 7: Junior Certificate students' performance in items relating to Strand 3 of the revised mathematics syllabuses

JC3/4/5 Item	Syllabus area	Item summary	Phase one students[1]	
			1 mark (%)	2 marks (%)
1	Number: percentages	Estimate percentage of four digit number	81	
2	Scientific notation	Evaluate number written in scientific notation	95	
3	Number: ratio	Find number of boys in a class given boy:girl ratio	67	
4	Number: fractions	Add and subtract simple fractions	49	
5	Applied measure	Find distance travelled in given time	88	
6	Number: operations	Perform division with negative number	80	
7	Number: prime factors	Recognise prime factors of four digit number	63	
8	Applied measure	Compare value for money of two pizzas based on surface area	2	
9	Applied measure	Interpret graph (speed of racing car on track)	95	
10a	Applied arithmetic	Currency conversion with given exchange rate	90	
10b	Applied arithmetic	Explain benefit of lower exchange rate	40	
11	Number: proportion	Understand proportional relationship (cost of apartment based on floor area)	8	

[1] Non-phase one students are not included in this table as they did not complete booklet JC 3/4/5.

Leaving Certificate

A total of 210 students from phase one schools and 395 students from non-phase one schools completed the items assessing Strand 3 (Number). Performance in Strand 3 is shown in Table 8. Many of the items performed differently, some were easier and some were harder, compared with the class of 2012, but the overall scores of all the items in this section are broadly similar and items 7, 8b and 10 remain the hardest in this strand. Only phase one students completed these items in Spring 2012, but non-phase students in the class of 2013, who took the items in Autumn 2012 generally found these items harder than the phase one students.

Table 8: Leaving Certificate students' performance in items relating to Strand 3 of the revised mathematics syllabuses

Item	Syllabus area	Item summary	Phase one		Non-phase one	
			1 mark (%)	2 marks (%)	1 mark (%)	2 marks (%)
1	Area	Find area of square floor	71		69	
2	Percentages	Design system of coins under set conditions	23		17	
3	Area	Compare surface area of regular and irregular shapes	50		38	
4	Length	Estimate perimeter of regular shapes	27	24	34	15
5	Problem-solving	Find how many bookshelves can be made from constituent parts available	77		62	
6	Operations	Find thickness of paper folded multiple times	40		32	
7	Geometric series	Find sum of infinite geometric series	17		12	
8a	Patterns	Recognise pattern present in flashes of lighthouse	68		61	
8b	Patterns	Construct pattern of lighthouse flashes under set conditions	9	30	8	22
9	Area	Estimate how many people fit in a field of given dimensions	23		25	
10	Induction	State the steps required for proof by induction	0		1	

Strand 4: Algebra

All students in phase one schools had studied Strand 4 (Algebra). In non-phase one schools, just Leaving Certificate students had studied this strand.

Junior and Leaving Certificate students were assessed against a number of items relating to Strand 4 of the revised mathematics syllabuses. For Leaving Certificate students, these included 'expressions' (4.1), 'solving equations' (4.2), 'inequalities' (4.3), and 'complex numbers' (4.4). For Junior Certificate students, these included: 'representing situations with tables, diagrams and graphs' (4.2), 'finding formulae' (4.3), 'examining algebraic relationships' (4.4), 'relations without formulae' (4.5), 'expressions' (4.6) and 'equations and inequalities' (4.7).

Junior Certificate

A total of 210 students from phase one schools completed the items assessing Strand 4 (Algebra). Performance in Strand 4 is shown in Table 9. The broad pattern of performance is similar to the class of 2012 with items 12, 13c and 14 continuing to be particularly difficult with facilities less than 25 per cent. The first interim report (November 2012) noted that students tended to find items relating to this strand of the syllabus more difficult than their international counterparts, and this pattern holds true.

Table 9: Junior Certificate students' performance in items relating to Strand 4 of the revised mathematics syllabuses

JC3/4/5 Item	Syllabus area	Item summary	Phase one students[2]	
			1 mark (%)	2 marks (%)
12	Representing situations	Use numerical methods to extend pattern of matches	11	19
13a	Representing situations	Complete table of number of trees by expanding systematic pattern	12	63
13b	Equations	Solve equation with quadratic term	26	
13c	Algebraic relationships	Understand that squared terms increase more quickly than linear terms	18	8
14	Graphical relations	Interpret graph of motion (moving walkway)	19	
15	Inequalities	Solve linear inequality	37	
16	Expressions	Simplify linear expression with two variables	73	
17	Finding formulae	Express unknown length in terms of two variables	63	
18	Expressions	Evaluate expression with two variables	53	
19	Equations	Solve linear equation (shipping charges)	53	
20	Algebraic relationships	Determine which point is on a line (given equation)	30	
21	Finding formulae	Derive formula for linear relation between two variables	45	

Leaving Certificate

A total of 210 students from phase one schools and 395 students from non-phase one schools completed the items assessing Strand 4 (Algebra). Performance in Strand 4 is shown in Table 10 below. The performance follows the patterns set out in the class of 2012 with items 1b, 2a and 2b being the most difficult. Only phase one students completed these items in the class of 2012.

[2] Non-phase one students are not included in this table as they did not complete booklet JC 3/4/5.

Table 10: Leaving Certificate students' performance in items relating to Strand 4 of the revised mathematics syllabuses

Item	Syllabus area	Item summary	Phase one students		Non-phase one students	
			1 mark (%)	2 marks (%)	1 mark (%)	2 marks (%)
1a	Expressions	Evaluate expression with four variables	86		81	
1b	Expressions	Construct expression to meet specified conditions	35		21	
2a	Equations	Solve equation with two variables given value of one	4	65	5	53
2b	Equations	Solve equation with two variables given value of one	29	23	22	17
3	Complex numbers	Divide real number by complex number (using complex conjugate)	10		14	
4	Inequalities	Solve inequality (quadratic)	28		12	
5	Inequalities	Solve inequality (algebraic fraction)	6		2	
6	Expressions	Find minimum value of composite function	12		11	
7	Equations	Form quadratic function given points of intersection with both axes	7		2	

Strand 5: Functions

All students in phase one schools had studied Strand 5 (Functions). Phase one students had only covered this topic in the class of 2013.

Junior and Leaving Certificate students were assessed against a number of items relating to Strand 5 of the revised mathematics syllabuses. For Leaving Certificate students, these included: 'functions' (5.1) and 'calculus' (5.2) only. For Junior Certificate students, these included: 'graphing functions' (5.2).

Junior Certificate

A total of 421 students from phase one schools completed the two items assessing Strand 5 (Functions). Performance in Strand 5 is shown in Table 11. This strand was not assessed in the class of 2012 trial and the items are new additions to both of the Junior Certificate booklets. From the pool of international items from which the indicator item booklets were constructed, only two items of appropriate difficulty and mathematical content were identified. This limits the conclusions that can be drawn regarding the performance of

students within strand 5. However, both of the items have reasonable facilities (between 20 and 90 per cent) showing that neither item is particularly easy or difficult. Item 22 was also trialled with the Leaving Certificate students. Surprisingly, the older students have not performed better. It is not clear why this should be, but it supports the finding from the attitude survey that Leaving Certificate students are significantly more likely than Junior Certificate students to state that they find representing relationships 'a little difficult' or 'difficult'. It is possible that the greater confidence of the Junior Certificate students who have less association with previous syllabuses is having an effect. As the item was sourced from the PISA survey, no comparisons can be made to international data.

Table 11: Junior Certificate students' performance in items relating to Strand 5 of the revised mathematics syllabuses

JC3/4/5 & JC1/2/5 Item	Syllabus area	Item summary	Phase one JC students[3]	Phase one LC students
			1 mark (%)	1 mark (%)
22	Graphing functions	Identify the graphical representation of a swing's movement over time	56	56
23	Graphing functions	Representing a function in a graphical form	23	-

Leaving Certificate

A total of 413 students from phase one schools completed booklets containing the items assessing Strand 5 (Functions). Performance in Strand 5 is shown in Table 12 below. The first interim report (November 2012) notes that the items assessing calculus were found to be particularly difficult by the class of 2012, and this remains so.

As calculus is not covered in the Foundation Level course, and some elements such as integration are only covered at the Higher Level, it is of interest to look at the item facilities of the different student level groups. Table 12 also details the facilities of the Ordinary Level and Higher Level students on all of the Strand 5 items. The Higher Level students will be completing a more advanced end of course test paper and therefore can be anticipated to score more highly on this trial paper than their peers. However, on items 6, 8 and 9, the Ordinary Level students achieve slightly higher facilities. Of these, item 6 assesses functions while items 8 and 9 assess calculus. A similar comparison carried out on the class of 2012 did not show this unusual pattern for items 8 and 9 (item 6 was not analysed by student level). It is not clear why the Ordinary Level students are performing better than their Higher Level counterparts.

The omission rates of the Stand 5 items are high. This may have been caused by a combination of factors: the high demand of the items, the open response formats of several of the items and the positioning of the items at the end of both of the Leaving Certificate

[3] Non-phase one students are not included in this table as they did not complete the functions items.

indicator item booklets. The omission rates for the Strand 5 items were also high in the class of 2012.

Table 12: Leaving Certificate students' performance in items relating to Strand 5 (Functions)

Item	Syllabus area	Item summary	Phase one students	Ordinary level students (N=232)	Higher level students (N=176)
			1 mark[4] (%)	1 mark (%)	1 mark (%)
1	Functions	Match story of phenomenon to graph (rising level of water in tank)	33	25	44
2	Calculus	Apply differentiation to find stopping distance of car	7	4	11
3	Functions	Match story of phenomenon to graph (height of feet above ground while swinging)	56	53	60
4a	Calculus	Find where function of order four cuts x-axis	2	0	4
4b	Calculus	Find maxima and minima of function (differentiate)	0	0	1
5	Calculus	Link slope of trigonometric function to its derivative	3	0	7
6	Functions	Find number of integer coordinates on graph of fractional function	17	21	13
7a	Calculus	Find values where function is not continuous (given graph)	5	2	9
7b	Calculus	Find values where function is not differentiable (given graph)	1	0	3
8	Calculus	Find value of definite integral (given area between function and x-axis)	20	24	15
9	Calculus	Integrate exponential function	14	15	13

[4] Non-phase one students are not included in this table as they did not complete the functions items.

NFER provides evidence for excellence through its independence and insights, the breadth of its work, its connections, and a focus on outcomes.

- independent
- insights
- breadth
- connections
- outcomes

National Foundation for Educational Research
The Mere, Upton Park
Slough, Berks SL1 2DQ

T: 01753 574123
F: 01753 691632
E: enquiries@nfer.ac.uk
www.nfer.ac.uk