Qualifications and Curriculum Authority

Evaluation of participation in GCE mathematics

Appendix I: Report on case study centre student questionnaire 2006

QCA Research Faculty

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Report on case study centre student questionnaire

The sample

The 19 case study centres involved in QCA's evaluation of participation in GCE mathematics were asked to disseminate a short questionnaire to their A level mathematics students in January 2006 as they had at the same point in 2005. In total, 1,151 students from all 19 of the case study centres responded to the questionnaire. Last year, teachers from 18 of the centres organised a response and 1,156 returns were received. Many of the students will have responded last year as AS students and this year as A2 students, but many were responding for the first time this year as AS students. We are very grateful to the staff for organising the high levels of returns and to the students themselves for answering our questions.

Table 1 shows the number of students responding from each of the case study centres. Each centre is represented by a code number. One centre dropped out of the evaluation during its first year, explaining the absence of centre code 2. The mean average number of responses per centre was just over 60, but returns varied between 6 and 319 dependent on centre size. It is worth noting that responses from centre 20, a sixth-form college, comprise over one quarter of the sample. Four other centres (6, 10, 13 and 18) account for approximately one third of the sample. Thus five centres provided more than one half of the student sample.

Table 1: Number of responses per centre

Centre code	Frequency	%
1	120	10.4
3	46	4.0
4	16	1.4
5	14	1.2
6	82	7.1
8	24	2.1
9	31	2.7
10	94	8.2
11	61	5.3

12	22	1.9
13	106	9.2
14	6	.5
15	47	4.1
16	25	2.2
17	24	2.1
18	100	8.7
19	14	1.2
20	319	27.7
Total	1,151	100.0

Table 2 shows the number of students responding from different centre types. Just over one half of the 1,151 responses came from students at state comprehensive schools. A little over one quarter came from one sixth-form college, and 1 in 10 from further education / tertiary colleges. About 1 in 20 students were from grammar schools, as for independent schools, and in this case it follows that 1 in 10 responded from a selective school.

Table 2: Number of responses per centre types

	Frequency	**%**
State	582	50.6
Independent	65	5.6
Grammar	61	5.3
Sixth	319	27.7
Further education / tertiary	124	10.8
Total	1151	100.0

Table 3 shows that by far the most respondents were from centres with a mixed intake of both boys and girls. Around 20% were from single-sex schools with a fairly even split between girls schools and boys schools.

Table 3: Centre gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Boys	106	9.2	9.2	9.2
	Girls	136	11.8	11.8	21.0
	Mixed	909	79.0	79.0	100.0
	Total	1,151	100.0	100.0	

Q1. Are you male or female?

All but one of the students responded to indicate their gender. Table 4 shows that more male students than female students are represented in the sample. This compares with national data showing that more male students are taking A level mathematics than female students.

Table 4: Gender of the students in the sample

		Frequency	Percent
	Male	659	57.3
	Female	491	42.7
	Total	1,150	99.9
Missing	System	1	.1
Total		1,151	100.0

Q2. What is your date of birth?

Table 5: Student age in years

	N	Minimum	Maximum	Mean
All students	1147	16	32	17.8
Year 12/AS	714	16	32	17.5
Year 13/A2	419	16	23	18.2

The average age of the A level mathematics students responding to the questionnaire was 17.8 years. The average age of the year 12/AS students (17.5 years) was a little under a year lower than the average age of the year 13/A2 students (18.2 years).

Q3. Are you currently studying mathematics at AS or A2 / year 12 or year 13?

Students at the 18 case study centres offering A level mathematics as a modular course with assessments taken at the end of each module were asked whether they were studying mathematics at AS or A2. Students at the one centre offering A level mathematics as a linear course, with assessments taken on completion of the course, were asked whether they were studying mathematics in year 12 or year 13.

Table 6 shows the responses for students on the standard modular course. All but seven of the students at the modular centres responded. About two-thirds of the students were studying AS mathematics and about one third were studying A2 mathematics. Two students were studying AS and A2 mathematics concurrently. They may have been completing their AS units along side their new A2 units in year 13.

Table 6: Level of study for students on a modular course

		Frequency	**%**
	AS	682	65.3
	A2	352	33.7
	AS&A2	4	.4
	Total	1,038	99.3
Missing	System	7	.7
Total		1,045	100.0

Table 7 shows the responses for students at one centre on the linear course. Two of the students did not respond to this question and two students gave an invalid response by selecting both years. In a reversal of the pattern seen in Table 6, one third of the students were in their first year of study and two-thirds were in their second year of study.

Table 7: Year of study for students on a linear course

		Frequency	%
Valid	Y12	33	31.1
	Y13	69	65.1
	Invalid	2	1.9
	Total	104	98.1
Missing	System	2	1.9
Total		106	100.0

Q4. What grade did you get for GCSE mathematics?

Table 8: GCSE mathematics grades in 2005/6

		Frequency	%
Valid	A*	395	34.6
	A	495	43.3
	B	221	19.4
	C	29	2.5
	D	1	.1
	G	1	.1
	Total	1,142	100.0

Table 8 shows the prior attainment of the students responding to the questionnaire in terms of GCSE mathematics. Most of the respondents had gained grade A or A* (77.9%). This is slightly higher than the previous year of data collection (73.1% had gained A or A*) as shown in Table 9 below. Continuing this trend, there were more students with grade B in 2004/5 than in 2005/6. There was a similar proportion of grade C students.

Table 9: GCSE mathematics grades in 2004/5

		Frequency	%
Valid	A*	344	30
	A	494	43.1
	B	272	23.8
	C	31	2.7
	D	4	.3
	Total	1,145	100

Q5. At AS, which subjects are you taking/did you take?

There were 1,146 valid responses to this question. Table 10 gives the number of students who had or were studying each subject and this number as a percentage of the 1,146 responses to this question. Subjects given by 1% or more of the sample are reported here. 1,106 of the students said they were studying mathematics but the questionnaire was only answered by mathematics students. Thus 40 of the mathematics students answering this question did not enter mathematics in response to the question. Around a third of the 1,146 mathematics students were also studying physics, biology or chemistry. Around 17% were studying English or modern foreign languages (MFL), and between 13 and 14% were studying history, economics or psychology. Just over 11% were studying further mathematics.

Table 10: AS subjects taken by the mathematics students

Subject	Frequency	Valid%1146
Mathematics	1106	96.5
Physics	396	34.6
Chemistry	390	34
Biology	375	32.7
English	203	17.7
Modern foreign languages	193	16.8
History	160	14
Economics	158	13.8
Psychology	151	13.2

General studies	142	12.4
Geography	141	12.3
Further mathematics	127	11.1
ICT	118	10.3
Business studies	113	9.9
Art and design	109	9.5
Computing	107	9.3
Critical thinking	97	8.5
Music	63	5.5
Physical education	59	5.1
Accounting	55	4.8
Design and technology	49	4.3
Graphics	49	4.3
Religious studies	47	4.1
Electronics	39	3.4
Law	39	3.4
Government and politics	34	3
Philosophy	33	2.9
Drama and theatre studies	31	2.7
Sociology	31	2.7
Media studies	28	2.4
Music technology	15	1.3
Photography	14	1.2
Film studies	13	1.1
Economics and business studies	12	1
Textiles	12	1

Q6. At the end of AS, which subjects, if any, are you planning to drop/did you drop?

Of the sample of 1156 students, 717 (62%) indicated that they were planning to drop or had dropped a subject at the end of AS.

Table 11 shows the number of students taking each subject at AS and the number of students dropping or planning to drop each subject at the end of AS. The final column shows the proportion of students taking a subject who had dropped or were planning to drop each subject as a percentage. The data are presented in ascending order of the percentage.

The frequencies of AS subjects taken by less than 50 students in the sample were considered too low to support this analysis and are excluded from the data presented in this table.

Table 11: Subjects that A level mathematics students planned to drop/dropped at the end of AS

Subject	AS subject	AS drop	%
Physical education	59	22	37.3
Modern foreign languages	193	62	32.1
Psychology	151	37	24.5
Critical thinking	97	23	23.7
English	203	46	22.7
General studies	142	31	21.8
Economics	158	34	21.5
History	160	34	21.3
Geography	141	30	21.3
Accounting	55	11	20.0
Computing	107	21	19.6
ICT	118	22	18.6
Music	63	11	17.5
Art and design	109	19	17.4
Physics	396	60	15.2
Further mathematics	127	17	13.4
Biology	375	47	12.5
Chemistry	390	47	12.1
Business studies	113	12	10.6
Mathematics	1106	108	9.8

The fact that mathematics is the subject with the lowest proportion of students dropping the subject is striking but this should be treated with caution, as discussed below. At 9.8% it is the

only subject with a drop-out rate of less than 10%. Physics is notably higher at 15.2% but chemistry and biology are around the mid-point at about 12%. It is worth noting that the proportions for the sciences are based on a lower number of responses but, at a little under 400 students, they are still a substantial basis for comparison with mathematics.

However, the proportion of students saying that they had dropped mathematics or were intending to drop mathematics will have been depressed by the fact that only current mathematics students were asked to respond to the questionnaire. As a result no year 13 / A2 students would be expected to say that they had dropped mathematics at the end of A2 (although four students said that they had, perhaps because they were completing the AS course in year 13). Figures for AS are also likely to be depressed, but to a lesser extent, by the absence of students dropping the subject in the first few months of the course before the questionnaire arrived in centres. Excluding year 13 / A2 students from the analysis makes a substantial difference to the patterns observable in the data. About 14% of the AS mathematics students said they planned to drop the subject at the end of AS. This represented the highest level of dropping and was followed by 13% of AS physics students and 11% of AS MFL students.

So, the inclusion of both AS and A2 students in Table 11 is most useful in understanding which subjects A level mathematics students tend to drop at the end of AS. The subjects with highest proportions are Physical education (PE), MFL, psychology, critical thinking and general studies. The subjects with the lowest proportions are physics, further mathematics (FM), biology, chemistry and business studies. This suggests that these A level mathematics students are focusing in on a coherent core of mutually relevant and closely-related subjects as they drop subjects that are perhaps seen as more peripheral to their intended career paths.

The tables 12–14 provide an analysis of students dropping subjects at the end of AS, split by prior attainment. The data include only AS students in order to improve the comparability of mathematics to other subjects. Data are provided for mathematics and two comparator subjects with the second and third highest level of planned dropping at the end of AS by AS students. Prior attainment is split into students with A* in GCSE mathematics and students with other grades (A–G) in mathematics.

Table 12: GCSE grade of AS mathematics students planning to drop mathematics at the end of AS

	GCSE		
	A*	**A–G**	**Total**
Drop	13	91	104
Total	182	509	691
%	7.1	17.9	15.1

Of A* students, 7.1% plan to drop mathematics at the end of AS whereas 17.9% of students with other GCSE mathematics grades plan to drop the subject then. As expected, prior attainment in GCSE mathematics is a predictor of continuation from AS to A2 level mathematics. Overall, 15.1% plan to drop mathematics at the end of AS. This figure is slightly higher than provided above because of the different base (only students providing their GCSE grade can be included here; this also applies to tables 13 and 14, for physics and MFL).

Table 13: GCSE grade of AS mathematics students planning to drop physics at the end of AS

		GCSE		
		A*	**A-G**	**Total**
Drop	AS	9	19	28
Total		61	161	224
%		14.8	11.8	12.5

The pattern evident for mathematics is reversed in the case of physics. Prior attainment in GCSE mathematics has less predictive value for continuation of A level physics beyond AS.

Table 14: GCSE grade of AS mathematics students planning to drop MFL at the end of AS

	GCSE		
	A*	**A–G**	**Total**
Drop	19	16	35
Total	42	66	319
%	45.2	24.2	11

Again, the pattern in mathematics is reversed for MFL and there is a substantial difference between very high levels of dropping amongst A* students compared with A–G students, though both proportions are relatively high.

Table 15 shows analysis of GCSE prior attainment in more detail for AS mathematics students planning to drop mathematics at the end of AS.

Table 15: All GCSE grades of AS Mathematics students planning to drop mathematics at the end of AS

		GCSE					
		A*	**A**	**B**	**C**	**D**	**Total**
AS Maths	Drop	13	54	31	5	1	104
	Total	182	329	161	18	1	691
%		7.1	16.4	19.3	27.8	100	15.1

We can look at mathematics in further detail by splitting prior attainment into grades A* to D. This table includes only students saying they were AS / year12 students currently taking only AS mathematics. Although the number of C and D grade students is small, the data do suggest a positive correlation between prior attainment and the proportion of students continuing with mathematics beyond AS. However, there are similar proportions of A and B grade students planning to drop at the end of AS.

Table 16 analyses the gender of the AS mathematics students planning to drop mathematics at the end of AS.

Table 16: Gender of AS mathematics students planning to drop mathematics at the end of AS

		Male_Female		
		Male	**Female**	**Total**
AS Maths	Drop	52	52	104
	Total	393	302	695
%		13.2	17.2	15

The proportion of female AS mathematics students planning to drop AS mathematics at the end of AS is slightly higher than the proportion of male students. However, this analysis does not show the prior attainment level of the male and female students and whether they were planning to continue or drop mathematics.

Table 17 takes the analysis a step further by combining the data on gender and all GCSE grades for AS mathematics students planning to drop mathematics at the end of AS.

Table 17: Gender and all GCSE grades of AS mathematics students planning to drop mathematics at the end of AS

This table provides frequencies rather than percentages.

		Gender	
		Male	**Female**
GCSE	A*	4	9
	A	28	26
	B	16	15
	C	4	1
	D	0	1
Total		52	52

The data presented in the Table 17 includes only AS students who were planning to drop mathematics at the end of AS. It analyses GCSE prior attainment in mathematics by gender. Comparison of the frequencies (since the numbers of male and female students is both equal and a low number) shows little difference by gender (although the low frequencies may or may not mask differences).

Q7. How did you find the move from GCSE mathematics to AS mathematics?

There were 1,139 students who responded to this question. They were given a five-point scale from 'very easy' through 'easy', 'OK', 'difficult' and 'very difficult'. The most frequent response was OK with 45.9%. A substantial proportion (nearly 30%) of the students had found the move from GCSE to A level mathematics difficult but relatively few had found it to be very difficult.

So, the responses tend towards OK and difficult; only 17% thought the move was easy or very easy.

Table 18: Moving from GCSE mathematics to AS mathematics

		Frequency	Percent
	Very easy	31	2.7
	Easy	165	14.3
	OK	528	45.9
	Difficult	343	29.8
	Very difficult	72	6.3
	Total	1139	99.0
Missing	System	12	1.0
Total		1151	100.0

Table 19 splits the responses from the students into year groups. Students on linear courses and those who said they are in both year groups have been excluded from this analysis. The responses are similar for year 12 and year 13 but a slightly lower proportion of year 12 students had found the progression very easy, easy or OK and a slightly higher proportion had found it difficult or very difficult.

Table 19: Moving from GCSE mathematics to AS mathematics – year 12 and year 13

			Move					Total
			Very easy	Easy	OK	Difficult	Very difficult	
	Year 12	Count	12	84	321	235	57	709
		% within year 12	1.7%	11.8%	45.3%	33.1%	8.0%	100.0%
	Year 13	Count	19	79	201	106	14	419
		% within year 13	4.5%	18.9%	48.0%	25.3%	3.3%	100.0%
Total		Count	31	163	522	341	71	1128
		% within years 12 and 13	2.7%	14.5%	46.3%	30.2%	6.3%	100.0%

However, it is not possible to infer from these data that the later cohort of students found the transition from GCSE to GCE more difficult than the previous cohort. This is because A2 students will tend to be more able mathematicians than AS students as a result of students dropping the course during or at the end of AS.

Table 20 shows responses split by prior attainment: GCSE grade A* and GCSE grades A–G (though almost all of the students gained A–C). This confirms expectations that A* students tend to find the transition from GCSE mathematics to AS mathematics easier than student with lower grades.

In both groups, most students characterised the move as OK, but whilst nearly 30% of A* students found the move easy or very easy, only a little more than 10% of A–G student did. And whilst 46.6% of A–G students found the change difficult or very difficult, only 17.8% of A* students did.

Table 20: Moving from GCSE to AS mathematics – split by GCSE A* and GCSE A–G

			Move					**Total**
			Very easy	**Easy**	**OK**	**Difficult**	**Very difficult**	
	A–G	Count	14	66	312	281	62	735
		% within A–G	1.9%	9.0%	42.4%	38.2%	8.4%	100.0%
	A*	Count	17	95	207	60	9	388
		% within A*	4.4%	24.5%	53.4%	15.5%	2.3%	100.0%
Total		Count	31	161	519	341	71	1123
		% within A* & A–G	2.8%	14.3%	46.2%	30.4%	6.3%	100.0%

Table 21 shows results for this question split by gender. Only small differences are in evidence.

Table 21: Moving from GCSE to AS mathematics – split by gender

			Move					Total
			Very easy	Easy	OK	Difficult	Very difficult	
	Male	Count	24	105	278	194	43	644
		% within male	3.7%	16.3%	43.2%	30.1%	6.7%	100.0 %
	Female	Count	7	58	243	147	28	483
		% within female	1.4%	12.0%	50.3%	30.4%	5.8%	100.0 %
Total		Count	31	163	521	341	71	1127
		% within male and female	2.8%	14.5%	46.2%	30.3%	6.3%	100.0 %

Q8. Please rank all the subjects you have taken at A level in terms of overall difficulty.

The responding students ranked all the subjects they had taken at A level in order of difficulty, with the subject they found easiest first and the subject they found hardest last.

A substantial number of students gave a different number of A level subjects in this question than in question 5, which asked for all AS subjects. This probably arose from confusion over the use of A level and AS in the two questions, but both questions were intended to find out about all the subjects the students had taken. The number of subjects each student gave should therefore have been the same in both questions. Data for students providing a different number of subjects than in question 5 have therefore been excluded from the analysis of this question. Subjects reported by fewer than 30 students have also been excluded from the analysis to ensure that the percentages shown below are meaningful.

The analysis includes data for the subject ranked easiest (first) by each student and hardest (last). The calculations for the subject ranked hardest takes account of the different A level programme sizes of different students. Students reported A level programmes ranging from two subjects to, in one case, seven subjects.

Table 22 shows the number of students taking each subject (total) and the number of students saying it was their easiest subject. It then gives the number of students ranking a subject as their easiest as a percentage of the total number of students taking the subject. It should be borne in mind that the rankings are those of students taking mathematics. Had the many students who were not taking mathematics been asked to rank their subjects, a quite different ranking of the subjects might have resulted.

The table also shows that mathematics is a long way down the list of subjects, with about 16% of the mathematics students saying that mathematics was their easiest subject. A very few students said that further mathematics was their easiest subject. This is noteworthy since these students all ranked mathematics as less easy than this more advanced iteration of the subject. Furthermore, only one of these five students ranked mathematics as their second easiest subject. We might infer that the students' responses emphasised the progress they have made in understanding mathematical concepts and their application.

Table 22: Frequencies and percentages for subjects ranked easiest

Subject	Easiest	Total	%
General studies	46	74	62.2
Art and design	39	79	49.4
Design and technology	15	32	46.9
PE	19	46	41.3
Geography	43	105	41
ICT	37	95	39
Music	14	40	35
Critical thinking	21	65	32.3
English	38	130	29.2
Accounting	9	32	28.1
Psychology	29	106	27.4
Business Studies	22	85	25.9

Modern foreign languages	27	111	24.3
Law	7	30	23.3
Religious studies	7	31	22.6
Biology	53	241	22
History	20	109	18.4
Physics	47	270	17.4
Economics	14	85	16.5
Mathematics	127	775	16.4
Computing	12	76	15.8
Chemistry	37	266	13.9
Graphics	4	35	11.4
Further mathematics	5	69	7.3

Table 23 shows the number of students ranking a subject as their hardest, the total number of student taking the subject and the number of students ranking the subject their hardest as a percentage of the total number of students taking a subject. Since students take different numbers of A level subjects and students were asked to rank their subjects, with the easiest first and the hardest last, this data is based on the subject ranked last (ranging from the second subject for students taking two A levels to seven subjects for the student taking seven A levels).

The table shows relatively high proportions of students (about one third) ranking mathematics and further mathematics as their hardest subjects. MFL is ranked the hardest subject by a similar proportion of A level mathematics students.

Twenty of the 25 students ranking FM hardest went on to rank A level mathematics their second hardest subject. Thus FM has reduced the number of students ranking ALM hardest by 20. If these students had not been taking FM then we can project that the proportion of ALM students ranking it the hardest subject would have been slightly higher at 34.3% (273/795*100).

Four of the 253 students ranking mathematics hardest went on to rank FM their second hardest subject.

Whilst a similar percentage of students ranked mathematics, physics or chemistry their hardest subject (around 30%), biology appears somewhat lower down the list of subjects (20%).

Table 23: Frequencies and percentages for subjects ranked hardest

	Hardest	Total	%
Further mathematics	25	69	36.2
MFL	37	111	33.3
Mathematics	253	775	32.6
Physics	78	270	28.9
Chemistry	71	266	26.7
Law	8	30	26.7
History	29	109	26.6
PE	12	46	26.1
Economics	22	85	25.9
Computing	18	76	23.7
Religious studies	7	31	22.6
Music	9	40	22.5
Accounting	7	32	21.9
Critical thinking	13	65	20.0
Biology	48	241	19.9
Psychology	20	106	18.9
Design and technology	6	32	18.8
Geography	17	105	16.2
Graphics	5	35	14.3
Business studies	12	85	14.1
ICT	13	95	13.7
English	17	130	13.1
Art and design	10	79	12.7
General studies	6	74	8.1

n=total30+

Q9. If you've had any results from AS or A2 mathematics exams were they, on the whole better than you expected, about the same as you expected, or worse than you expected?

There were 545 students who responded to this question. The remainder of the students (606) either had not received any GCE mathematics results yet or simply chose not to answer the question.

Most of the students responding to the question (56.5%) said that the mathematics results that they had so far received were about the same as they had expected. A slightly higher proportion of students said that their results were lower than expected (25.5%) compared with higher than expected (18%).

Table 24: GCE mathematics results so far versus expectations

		Frequency	Valid %
Valid	Better than you expected	98	18.0
	About the same as you expected	308	56.5
	Worse than you expected	139	25.5
	Total	545	100.0
Missing	System	606	
Total		1,151	

Table 25 shows the data split by gender with responses for 545 students included in the analysis.

One half of female students said their results were about what they expected. A quarter said their results were better than expected and about one quarter said they were worse than expected.

Similarly, one quarter of male students said their results were worse than expected but differences were apparent in the other two categories of response. More male students said

that their results were about as expected but more female students said that their results were better than expected.

It therefore seems that boys' expectations are more likely to be accurate, and girls' expectations are more likely to be pessimistic. Boys' expectations have a similar likelihood of being over-optimistic.

Table 25: GCE mathematics results versus expectations analysed by gender

			GCE maths results			
			Better than you expected	**About the same as you expected**	**Worse than you expected**	**Total**
	Male	Count	43	201	84	328
		% within male	13.1%	61.3%	25.6%	100.0%
	Female	Count	55	107	55	217
		% within female	25.3%	49.3%	25.3%	100.0%
Total		Count	98	308	139	545
		% male & female	18.0%	56.5%	25.5%	100.0%

Table 26 excludes students currently studying both AS and A2 or reporting themselves as being in both year 12 and year 13. Therefore there are 535 students included in this analysis. Year 12 students were more likely than year 13 students to say that their results were worse than they had expected and less likely to say that their results were better than expected. A very similar proportion said that their results were about the same as they expected.

Table 26: GCE mathematics results versus expectations analysed by year group

		Results			
		Better than you expected	**About the same as you expected**	**Worse than you expected**	**Total**
Y12	Count	17	88	49	154
	% within Y12	11.0%	57.1%	31.8%	100.0%
Y13	Count	80	216	85	381

	% within Y13	21.0%	56.7%	22.3%	100.0%
Total	Count	97	304	134	535
	% within Y12/Y13	18.1%	56.8%	25.0%	100.0%

Table 27 splits the students into those gaining an A* at GCSE and those gaining other grades (A–G). At more than 50%, each group was similarly likely to receive exam results that met their expectations. A* students were more likely to gain A level results that were better than expected, and A–G students were more likely to gain results that were worse than expected. One possible explanation for this is differing work ethics and motivations of these different types of students.

Table 27: Results versus expectations split by GCSE grade

			Results			**Total**
			Better than you expected	**About the same as you expected**	**Worse than you expected**	
Astar_Other	A-G	Count	44	172	92	308
		% within A–G	14.3%	55.8%	29.9%	100.0%
	A*	Count	51	133	46	230
		% within A*	22.2%	57.8%	20.0%	100.0%
Total		Count	95	305	138	538
		% within A*–G	17.7%	56.7%	25.7%	100.0%