



MAKING
MATHS
COUNT

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ADDITIONAL RESEARCH INFORMATION

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INTRODUCTION

The Making Maths Count Group undertook a range of research and engagement work to inform its final report¹. This included online questionnaires and focus groups to obtain an indicative snapshot of how the public use and view maths. A summary of the findings is contained in the final report. This research paper provides more detailed information on the results of the online questionnaires and focus groups.

The Group's interim report included results from survey work undertaken in 2013 for the Scottish Survey of Literacy and Numeracy (SSLN). Since then, results from the 2015 SSLN for numeracy have been published. A summary of the 2015 results are also contained in this paper.

SUMMARY OF RESULTS FROM ONLINE SURVEY AND FOCUS GROUPS

As part of its public call for evidence, the Making Maths Count Group produced two short online questionnaires to explore public perceptions of maths – one for adults and one for children and young people aged under 16. Issues raised in the questionnaires and wider evidence-gathering were explored in more depth in a series of focus groups.

Methods

Online questionnaires

The questionnaires were designed to provide an indicative snapshot of how the public view and use maths. They included questions about how people use maths in their daily lives; which aspects of maths, if any, they would wish to improve; and their ideas for creating greater public enthusiasm for maths. Background information on age, gender, educational attainment and employment status was collected for adults, and information on age, gender and school year was collected for children and young people. Respondents were informed that individual responses would remain anonymous.

The questionnaires were made available online using the Questback platform and accessed through a link on the Group's webpages (www.gov.scot/makingmathscount). The questionnaires were promoted via social media (@MathsScot) and by a broad range of networks including young people's organisations, parent forums and schools. The questionnaires were available for six weeks between 9 February and 22 March 2016.

Adults

In total, 2508 adults submitted a questionnaire response. Fourteen of these were removed because none of the questions had been answered, leaving 2494

¹ Scottish Government, *Making Maths Count*, Final Report (2016)
<http://www.gov.scot/Topics/Education/Schools/curriculum/MakingMathsCountScotland>

responses for analysis. Seventy six percent (1788) of adults who responded to the online questionnaire were female. The majority (69%) were between 35-54 years old and were working as an employee (74%).

| Age group | Percent | Employment status | Percent |
|-------------|-------------|----------------------------------|-------------|
| 16-24 years | 6% | Working as an employee | 74% |
| 25-34 years | 14% | Self-employed or freelance | 6% |
| 35-44 years | 37% | Owner of a business or company | 3% |
| 45-54 years | 32% | In higher education | 5% |
| 55-64 years | 10% | In further education | 3% |
| 65+ years | 1% | Looking after the home or family | 6% |
| N | 2462 | Unemployed | 2% |
| | | Retired from work | 2% |
| | | Other | 2% |
| | | N | 2479 |

Just over two-thirds (68%) of survey respondents said they are a parent or carer of child(ren) under-18. In general, respondents to the online survey were well educated: 64% had obtained a Bachelor's degree or higher (or equivalent, Scottish Credit and Qualifications Framework (SCQF) level 9 or above), whilst only 1% reported having 'no qualifications'.

| Highest qualification achieved | Percent |
|--|-------------|
| No qualifications | 1% |
| SCQF Level 5 and below (e.g. National 4/5, Standard Grade, GCSE or equivalent) | 10% |
| SCQF Level 6-8 (e.g. Higher, Advanced Higher, A Level, SVQ Level 3, HNC, HND or equivalent) | 25% |
| SCQF Level 9-10 (e.g. First Degree, Higher Degree or equivalent) | 29% |
| SCQF level 11 and above (e.g. Master's, doctorate, professional degree or equivalent) | 35% |
| N | 2478 |

Children and young people

In total 828 children and young people submitted a questionnaire response. Two of these were removed because none of the questions had been answered, leaving 826 responses for analysis. Just over half (53%) of the children and young people who responded were female. They were aged between 4 and 17, and the majority were in year P6 to S2 (71%). The average age was 12.

Focus groups

Focus groups were held at nine locations. These included two primary schools and one secondary school where discussions were held with pupils, teachers and parents; two colleges where discussions were held with students and staff; two universities where discussions were held with students involved in initial teacher education; a group of business representatives; and those involved in adult basic education. Topic guides were developed to explore areas covered in the online questionnaire in more detail, as well as issues specific to each stakeholder group (e.g. maths teaching, maths in initial teacher education). Focus groups were facilitated by group members and Scottish Government officials.

Findings

What maths means to people

In both the online questionnaires and at focus groups adults and young people were asked: “what does maths mean to you?”.

The most frequently used word for responses to the online survey was ‘numbers’ (396 times for adults, 149 times for young people). Terms for basic mathematical operations such as add, divide and multiplication came up more frequently in young people’s answers.

Words such as ‘difficult’ and ‘challenging’ came up with both young people and adults. Young people’s answers included ‘boring’ and ‘fun’ in equal numbers while among the adult responses, phrases such as ‘lifeskill’, ‘everyday’ and ‘problem-solving’ were prominent. While adult responses often associated maths with work or everyday life, many also linked back to school. Negative words included: ‘hard’, ‘boring’, ‘fear’, ‘difficult’, ‘dread’, ‘frustration’, ‘hate’, ‘shudder’, ‘panic!!!’.

For some of these respondents maths was linked to feeling anxious or inadequate: ‘anxiety, fear of failure’, ‘inadequate’, rubbish at maths’. For some this was linked to a lack of understanding or confidence: ‘difficult, confusing mass of patterns I do not fully understand’.

Positive words or phrases included: ‘fun’, ‘essential’, ‘excitement and enjoyment’, ‘awesome’, ‘empowering’, ‘favourite subject’, ‘interesting’, ‘challenging’, ‘satisfying’, ‘cool stuff’. Some comments underlined the respondents’ passion for maths: ‘I love maths!’; ‘fascinating, intriguing, patterns, mystery, beauty of numbers’; ‘a means of interpreting the world which is fun, logical and beautiful’.

In discussions amongst the focus groups, even for those no longer at school, there was often still an association between maths and their time at school. A number of the adults who had not achieved highly in maths at school, or enjoyed the subject, reported that they had gone on to develop a more positive relationship with the subject, whether that be because of more positive education experiences since school or through using maths in their work. For example, students accessing Adult Basic Education courses in Fife described maths at school as, “competitive”, “scary”, “just focused on exams.” They reported that since studying maths as an

adult they now thought of the subject as “important” and something “you need to use every day.” A high proportion of participants reinforced the importance of maths teaching in shaping how they felt about the subject.

The focus groups allowed for a greater amount of discussion about what people liked or disliked about maths. While some responded to this with specific areas of maths, such as liking algebra or disliking fractions, the themes tended to be more general, particularly with older participants.

Logic and getting ‘a right answer’ were highlighted both as a positive for some people and a negative by others. Comments included describing maths as, “black and white” and saying it, “gives you clear answers”. Some felt the right or wrong nature of the subject meant, if you were getting things right, you got quick positive reinforcement which could spur you on, with one comment that maths is “full of little successes”. However, those who lacked confidence in their ability spoke of the “pressure to come up with the right answer” and some talked about a preference for subjects like English where, “you can have an opinion”.

Amongst those who had not achieved highly in maths at school, feelings of “low expectations” were expressed and a number explained feeling like little was expected of them sometimes because of the area they came from.

A number of adults in the focus groups agreed that they hadn’t fully grasped the importance of maths until they had needed it later in life. One participant described how he had hated maths at school and it was only after entering the construction business he realised the value of the subject – this meant having to take evening classes to fill in gaps in his knowledge and he expressed a wish he’d done more maths at school. Amongst jewellery students at college there was a positive attitudes towards the maths in their course, largely because students felt the maths wasn’t segregated, it was just a part of the jewellery making process and it was in context for them.

Maths teachers were often mentioned and could have an important bearing on people’s feelings towards the subject. Different terms were also raised, such as arithmetic, numeracy and maths. In both the focus groups and the questionnaire responses some individuals felt numeracy and arithmetic were better words to describe the number skills people use in daily life and there were references to when ‘maths’ and ‘arithmetic’ were separated at school. For some the term ‘maths’ was equated with more complicated, abstract study which was not as relevant to everybody.

Students taking maths in S4-6 reported that maths differed from other subjects in terms of how you had to be ‘switched on’ every lesson because of the pace. Unlike other subjects they felt maths required more practise and technique in applying it. While it was a challenge, the students spoke of maths as a “foundation subject” which was “important” and “hard” and benefitted them in other subjects. Some students felt maths in primary school was more interactive and less rushed. Students not taking maths beyond S4 talked about losing confidence, too much content and a lack of opportunity to discuss what they were learning as they did with other subjects.

Pupils were aware that certain maths qualifications are often asked for, in particular for specific further and higher education courses, but they didn't always see the relevance and it was viewed as a tickbox exercise at times.

How people are using maths

The questionnaires asked: *during the last week, have you used maths for any of the following activities?* In general respondents recognised that they used maths to help them with a wide range of activities. Adults were most likely to say they had used maths to help them better manage their money (94%), with day to day activities (92%) or for work (91%) during the last week. 64% said they used maths to help them understand statistics in the media. 58% of those who studied said they used maths to help with their studies, whilst 86% of parents said they used maths to help their child(ren) with their learning.

Table 1: Adults: have you used maths for any of the following activities?

| Activity | Yes | No | I never use maths for this | Valid Total | Total |
|--|-----|-----|----------------------------|-------------|-------|
| For work | 91% | 7% | 1% | 2283 | 2465 |
| To help me with day to day activities (e.g. cooking, DIY, planning my time etc) | 92% | 7% | 1% | 2442 | 2454 |
| To help me in my studies | 58% | 39% | 3% | 1158 | 2418 |
| To better manage my money (e.g. budgeting, finances, getting the best deals, shopping etc) | 94% | 5% | 1% | 2455 | 2464 |
| To help my child(ren) with their learning | 86% | 13% | 1% | 1865 | 2456 |
| To help me understand statistics in the media | 64% | 32% | 4% | 2285 | 2432 |

When asked what other activities they used maths for, respondents recognised that they use maths for a very wide range of activities. Activities mentioned included: exercise and counting calories, board games (cards, bridge) and doing puzzles, cooking and baking, art and crafts, planning and timetabling, home decorating and building, computer programming, filling in a tax return, driving and travel, telling the time, gardening, monitoring health and taking medication, and 'working out my babies weight & percentile'. Some mentioned their work, a few made a distinction between arithmetic and maths, whilst others thought they needed maths for almost everything.

The focus groups largely mirrored the online survey, with a similar range of activities suggested. Shopping, for example working out offers, and managing finances were the most commonly discussed ways of using maths, regardless of occupation. Children and young people were most likely to say they had used maths to help them with day to day activities (73%), with playing games (70%) and to help family and friends with their maths (67%). They were less likely to say they had used maths

to help them understand news stories (54%) or whilst taking part in groups they belong to (55%).

Table 2: Children: have you used maths for any of the following activities?

| Activity | Yes | No | I never use maths for this | Valid Total | Total |
|--|-----|-----|----------------------------|-------------|-------|
| To help me with day to day activities (for example, planning my time, shopping, cooking) | 73% | 23% | 4% | 771 | 810 |
| Whilst taking part in groups that I belong to (for example, sports clubs, youth groups) | 55% | 35% | 10% | 772 | 807 |
| To help me with playing games (for example, computer games, board games) | 70% | 24% | 6% | 777 | 807 |
| To help me understand news stories (for example, understanding tables and diagrams) | 54% | 40% | 6% | 730 | 804 |
| To help family and friends with their maths | 67% | 30% | 4% | 741 | 810 |

Other activities children and young people mentioned using maths for included: cooking and baking, shopping, budgeting, travel and timetables, music, art, sewing, wages, exercising and sports, telling the time, revision and homework.

Children and young people were also asked: *which of the following activities do you think you will need to use maths for in the future?* Most thought they would need to use maths to better manage their money (94%), to help them with everyday tasks (88%), for their job (85%), to help their children with their learning (85%), and to help with their future learning (85%). Only just over a third thought they would need to use maths to help them understand news stories (37%), whilst 35% were unsure.

Table 3: Children: activities you will need to use maths for in the future?

| Activity | Yes | No | Unsure | N |
|--|-----|-----|--------|-----|
| For my job | 85% | 7% | 8% | 820 |
| To help me with everyday tasks (e.g. shopping, cooking, DIY) | 88% | 6% | 7% | 815 |
| To help me in my future learning | 85% | 7% | 9% | 816 |
| To help me manage my money better | 94% | 3% | 3% | 813 |
| To help my children with their learning | 85% | 7% | 8% | 815 |
| To help me understand news stories | 37% | 35% | 28% | 804 |

Other activities children and young people thought they would use maths for in the future included: managing time, exercise and sports, health, hobbies, games, music, travel and buying a house.

In the focus groups, pupils recognised a wide range of careers that would require knowledge of maths. The range of jobs discussed tended to narrow as the age of the pupils increased. For example amongst one group of primary pupils there was a strong belief every job required some maths and they discussed how it could be of use to a footballer or actress. The list narrowed to more typical STEM (Science, Technology, Engineering and Mathematics) occupations with older pupils, such as engineering and medicine.

Some older pupils reported that as they moved up the school less of the maths they study is relevant to their lives. They recognised they used maths when doing their shopping and managing their money, but felt the maths needed for this was very 'simple'.

Commonly used aspects of maths

The questionnaires asked: *during the last week, have you used the following aspects of maths?* Almost all adults said they had used 'adding and subtracting' over the last week (99%). Most also said they had used 'multiplying and dividing' (94%), 'measurement' (84%) and 'fractions, decimal fractions and percentages' (83%). Respondents were less likely to have used statistics (64%) and logic (74%).

Table 4: Adults: have you used the following aspects of maths?

| Aspect of maths | Yes | No | Unsure | I never use this aspect of maths | Total |
|--|------------|-----------|---------------|---|--------------|
| Adding and subtracting | 99% | 1% | - | - | 2485 |
| Multiplying and dividing | 94% | 5% | 1% | - | 2470 |
| Fractions, decimal fractions and percentages | 83% | 15% | 2% | 1% | 2453 |
| Measurement (e.g. calculating lengths, distances, weights and volumes) | 84% | 14% | 1% | 1% | 2453 |
| Statistics (e.g. analysing data shown in tables and diagrams) | 64% | 32% | 2% | 2% | 2442 |
| Logic (e.g. problem solving) | 74% | 20% | 5% | 1% | 2427 |

When asked about other aspects of maths they used, some respondents gave examples of the categories above (e.g. budgeting/accounts, ratios, cooking, shopping, measuring curtains, puzzles). Other aspects of maths mentioned included: telling the time, probability/chance, algebra, calculus, trigonometry, geometry, programming, matrices, differentiation, integration, modelling. Some noted that they thought these aspects provided were arithmetic not maths.

Children and young people were asked: *during the last week, have you used any of these aspects of maths outside school?* Most reported using 'adding and subtracting' over the last week (87%). Around two thirds said they had used 'multiplying and dividing' (67%) and 'logic' (69%), whilst just over half said they had used

'measurement' (54%). Respondents were less likely to think they had used 'fractions, decimal fractions and percentages' (40%) and statistics (34%).

Table 5: Children: have you used any of these aspects of maths outside school?

| Aspect of maths | Yes | No | Unsure | I never use this aspect of maths | N |
|---|-----|-----|--------|----------------------------------|-----|
| Adding and subtracting | 82% | 13% | 5% | 1% | 806 |
| Multiplying and dividing | 67% | 24% | 8% | 1% | 802 |
| Fractions, decimal fractions and percentages (for example, working with parts of a whole number) | 40% | 46% | 12% | 3% | 803 |
| Measurement (for example, working out how long or heavy an object is, or how far away something is) | 54% | 36% | 8% | 2% | 801 |
| Statistics (for example, understanding information shown in tables and diagrams or presenting information in tables and diagrams) | 34% | 49% | 12% | 5% | 798 |
| Logic (for example, solving problems) | 69% | 21% | 8% | 2% | 801 |

Other aspects of maths children and young people mentioned using included: time, shapes, angles, factors, algebra, integers, scale drawing and trigonometry.

Improving maths skills

Adults were asked if they would like to improve their maths skills. 58% (1446) said they would like to improve their maths skills. Younger respondents were more likely to want to improve their maths skills than older respondents (69% of 18-34 year olds compared to 56% of those 35 and over). Those who were less well educated were also more likely to want to improve their maths skills (70% of those whose highest qualification was SCQF level 5 or lower wanted to improve their maths skills, compared to 55% of those whose highest qualification was SCQF level 9 or above). The most common reasons for this were 'to be able to better help my child(ren) with their learning' (mentioned by 49%), 'to become better at my current job' (mentioned by 41%) and 'to better manage my money' (29%). The least common reason was 'to help me get a job', which was only selected by 5% of those who wanted to improve their maths skills.

Table 6: Adults: what are the reasons for wanting to improve your maths skills?

| Reasons for wanting to improve maths skills | Percent | Count |
|--|---------|-------|
| To help me get a job | 5% | 71 |
| To help me get a better job | 12% | 175 |
| To become better at my current job | 41% | 582 |
| To become better at day to day activities (e.g. cooking, DIY, planning my time etc) | 24% | 335 |
| To help me in my studies | 13% | 188 |
| To better manage my money (e.g. budgeting, finances, getting the best deals, shopping etc) | 29% | 406 |
| To be able to better help my child(ren) with their learning | 49% | 690 |
| To better understand statistics in the media | 22% | 311 |
| Other | 21% | 296 |
| Total | | 1424 |

Around a fifth of respondents (21%) mentioned another reason for wanting to improve their maths skills. These included: for their own enjoyment, satisfaction, self-improvement or to keep their mind active/improve memory; to increase confidence; to refresh their memory; to learn the current methods their child is learning at school; to develop their knowledge in particular areas (apply modern techniques in statistics, programming, logic, calculations in advanced physics, fluid mechanics, Fourier Transforms, maths-related tools (Excel)).

Statistics (selected by 54%), logic (54%), and fractions, decimal fractions and percentages (38%) were the most common aspects of maths that respondents wanted to improve.

Table 7: Adults: which aspects of maths would you most want to improve?

| Aspect of maths | Percent | Count |
|---|---------|-------|
| Adding and subtracting | 7% | 100 |
| Multiplying and dividing | 15% | 214 |
| Fractions, decimal fractions and percentages | 38% | 526 |
| Measurement (e.g. calculating lengths, weights and volumes) | 23% | 318 |
| Statistics (e.g. analysing data shown in tables and diagrams) | 54% | 757 |
| Logic (e.g. problem solving) | 54% | 750 |
| Other | 21% | 288 |
| N | | 1402 |

Around a fifth of respondents (21%) said they would like to improve another aspect of maths. Aspects suggested included: geometry, calculus, algebra, group theory, surds, integrals, probability, trigonometry, advanced modelling, differentiation, writing code, complex statistical methods.

Children and young people were also asked: *which aspect of maths would you most want to improve?* Fractions, decimal fractions and percentages (selected by 63%), statistics (selected by 48%) and logic (47%) were the most common aspects of maths that respondents wanted to improve. 40% wanted to improve their skills in

measurement and a third (33%) in multiplying and dividing. Only 14% wanted to improve their skills in adding and subtracting.

Table 8: Children: which aspects of maths would you most want to improve?

| Aspect of maths | Percent | Count |
|---|---------|-------|
| Adding and subtracting | 14% | 108 |
| Multiplying and dividing | 33% | 251 |
| Fractions, decimal fractions and percentages for example, working with parts of a whole number) | 63% | 481 |
| Measurement (for example, working out how long or heavy an object is, or how far away something is) | 40% | 307 |
| Statistics (for example, understanding information shown in tables and diagrams or presenting information in tables and diagrams) | 48% | 371 |
| Logic (for example, solving problems) | 47% | 357 |
| Other - please let us know which other aspect of maths you would like to improve: | 19% | 145 |
| N | | 768 |

Other aspects of maths children and young people wanted to improve included: National 5/Higher maths content, equations, algebra, telling the time, Pythagoras, trigonometry, mental maths, negative numbers.

Of the 42% of adults who did not want to improve their maths skills, most (89%, 917) said that the reason for this was because “I can do everything I need to with my current maths skills”. Only 4% (41) said they didn’t have time and 3% (29) that they weren’t interested (of 1029), whilst 4% (942) gave another reason.

Increasing public enthusiasm for maths

At the end of the questionnaire both adults and children and young people were asked: “what would make you more enthusiastic about maths?” Many of the suggestions provided to both the online questionnaire and focus groups highlighted the need to make maths relevant, or the need to make maths, and the teaching of the subject, more fun and engaging.

Some adults responses highlighted that they are already very passionate about maths and confident in their maths skills. Suggestions for increasing enthusiasm included:

- Improving maths teaching to be more inspiring/engaging/enthusiastic
- Shifting the focus to overcoming a challenge, the growth mindset
- Helping people see how maths is useful to them and how it can be used in everyday life/real world applications
- Making learning about maths more fun
- Raising confidence and making maths easier to understand.
- Changing societal attitudes towards maths
- Provision of free support, online training, and intermediate maths training
- Child/parent classes to receive up to date methods of teaching

Children and young people's suggestions for making them more enthusiastic about maths included:

- More fun/understanding/enthusiastic teachers.
- Teachers who enjoy maths,
- Making maths more fun/interactive/interesting, playing games, competitions, working in groups, peer-to-peer learning opportunities
- Relating maths to everyday life and future jobs
- Classes at the right level (harder questions, more challenging maths, easier work)
- More positive attitude towards maths
- Provide more information to parents

SCOTTISH SURVEY OF LITERACY AND NUMERACY

Our interim report² included results from survey work undertaken in 2013 for the Scottish Survey of Literacy and Numeracy (SSLN). Since then, results from the 2015 SSLN for numeracy have been published³.

The SSLN is a sample survey which monitors national performance in literacy and numeracy in alternative years. The survey assesses learners at P4 (ages 8-9), P7 (ages 11-12), and S2 (ages 13-14).

The 2015 survey found that 66% of P4 learners performed well or very well at the relevant curriculum level for their stage. This indicates a decline in performance from the previous surveys in 2011 and 2013 which showed figures of 76% and 69% respectively.

For P7 learners, the 2015 survey showed that 66% of these learners performed well or very well at the relevant curriculum level for their stage. This is a similar level of performance to 2013 but a decline from 2011 where the figure was 72% of P7 learners.

For S2 learners, the 2015 survey showed that 40% performed well or very well at the relevant curriculum level for their stage. The performance of S2 learners was statistically similar across all three survey years.

The 2015 survey found that boys outperformed girls at S2 but there were no statistically significant differences at P4 and P7. The 2015 survey also showed that pupils from the least deprived areas outperformed more deprived pupils across all stages. Between 2011 and 2015, the performance gap between least and most deprived pupils increased at P4 and remained the same for P7 and S2 pupils.

² Scottish Government, *Making Maths Count – Interim Report* (2016)
<http://www.gov.scot/Resource/0049/00497342.pdf>

³ Scottish Government, National Statistics *Scottish Survey of Literacy and Numeracy 2015* results
<http://www.gov.scot/Resource/0050/00500749.pdf>



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