

The Future of Mathematics Teaching in Scotland

There have been many changes in Scottish education over the last ten years that have had a significant impact on practice in teaching. The Scottish Mathematical Council (SMC¹) has been aware of the serious concerns felt by the community it represents. These include issues affecting recruitment as well as the support, leadership and direction of mathematics in Scottish schools. In order to gather factual information about current concerns in the profession, from the perspective of practitioners, the SMC devised a questionnaire and sent it to all Principal Teachers of Mathematics in Scotland. The findings from this survey were reported in the SMC Journal 34. One of the issues was subsequently highlighted in *The Herald* through its front-page coverage under the headline of “*Teachers ring alarm bells over maths shortages*” (11 May 2005). This pamphlet seeks to draw attention to the other issues raised by the profession, by making a summary of the survey responses available to a wider audience.

What are the concerns?

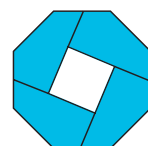
The changes in Scottish education have had a particular impact at ‘subject level’, so the views of Secondary mathematics teachers provide useful insights into the future of mathematical education. Various aspects of the mathematics education system in Scotland were explored with the survey respondents, including:

- the consequent changes following the Scottish Examination Board being replaced by the Scottish Qualifications Authority (SQA)
- the new National Qualification (NQ) framework
- the mathematics advisory role largely being removed or replaced by quality assurance personnel
- the recruitment difficulties and shortage of mathematics teachers in Scotland
- the new career structure for teachers that calls into question the role of subject-leadership in schools – as outlined in *The Teaching Profession for the 21st Century*

Within a few weeks of sending the 417 questionnaires, 249 replies were received. We believe this response rate of 60% highlights the strength of concern expressed by the respondents.

The remainder of this document is a summary of the results of an independent analysis of the questionnaire responses followed by a discussion section compiled by members of the SMC.

The Scottish Mathematical Council



¹ The SMC has around 15 members, representing school teachers, Council QI officers (formerly advisors), FE and HE lecturers (both Mathematics and Education faculties (ITE)), and business or industrial mathematicians. The Council aims to support and further the well-being of mathematical education in Scottish schools.

Summary of Responses

Significant concerns amongst Principal Teachers of mathematics in all local authorities are reported in the responses. Qualitative comments given by respondents highlight the strong consensus of views and experiences across the sector. The figures cited represent percentages of those who responded; non-response rates on any individual item are provided in the detailed analysis.

Support/ Sharing Ideas

84% feel that there has been a reduction in the number of opportunities for teachers from different schools to share ideas

84% believe the 'Advisory Service' no longer provides adequate subject specific support

79% think there is inadequate opportunity to meet with SQA and 97% would value such meetings

54% feel isolated with nobody offering direction in Mathematics

The SMC conference and Principal Teacher meetings/networks were the most notable examples of opportunities to share ideas. It can be difficult, however, for staff to find the time or cover to allow them to attend. Costs can also be prohibitive. The majority of respondents felt that the loss of an advisory service, or more specifically 'subject advisors', was having a detrimental effect on subject organisation.

Specific issues relating to the SQA related to costs, the centralised location of events and scope for expanding seminars to qualifications other than Higher Maths.

Future Direction

86% believe that Intermediate 2 is not as good a preparation for Higher as S Grade

Comments suggest that Intermediate 2 is valuable as an end-point itself, but not as preparation for Higher; in practice, conversion to Higher is poor. Problems with Intermediate 2 include the level of algebra, problem solving, reasoning and the application of skills.

Some general worries about changes in the mathematics curriculum were also raised, in particular: a fragmentation of 5–14, S Grade and Higher, and perceived lowering of standards.

77% think that the move to Faculty Heads² will have an adverse effect on management of Maths departments

The main issues for the respondents are:

- Workload & time to fulfil the remit. This is directly linked to the effects already being felt by PTs, due to the loss of APTs.
- The ability of a Faculty Head to manage and offer leadership where they are not the subject specialists. Specific problems include:
 - Planning and development of curriculum
 - Implementation of new initiatives (subject specific pedagogical skills)
 - 'Fighting the corner' for Mathematics
 - Allocation of resources
 - Ensuring commitment from departmental staff to take on tasks previously done by subject PT

² Use of 'new' management structures under the McCrone settlement to facilitate more flexible arrangements, where responsibility for management lies with faculty head rather than departmental principal.

Most respondents felt that Mathematics should be treated as a single faculty and in many cases staff have successfully argued such a case. However, in smaller schools, the fear is that this will not be possible. There were few positive comments about this development. Most of those who said there would be no adverse affect did so because Mathematics is, or will be, a single faculty in their school or because their Head of Faculty is a Maths specialist.

77% do not think that Mathematics Education in Scotland is being driven forward in a thoughtful, positive way

70% have experienced teacher recruitment shortages in Mathematics

This seems to be a major concern across most of Scotland. A significant number of schools have been at least 'one teacher' short for long periods resulting in the use of non-specialists to cover classes and consequently cutting maths sessions. The main issues are:

- Lack of supply teachers, particularly for long-term absence and maternity cover
- Few applicants for advertised posts – full-time, part-time and temporary
- Poor quality of applicants and supply teachers

Some of the schools not currently experiencing problems have a large number of staff coming up to retirement in the next few years and fear replacement will be difficult. See Statistical Publication: Edn/G5/2005/2: Teachers in Scotland, 2004 for a statistical breakdown, available at: www.scotland.gov.uk/Publications/2005/04/25165316/53178

67% are not optimistic about the future of Mathematics Education in Scotland

The main problems mentioned were confusion and inconsistencies caused by too many changes over too short a time, often made by people not directly dealing with pupils. There is a need for consolidation and national leadership from staff with the appropriate expertise.

Detailed Analysis

Responses by Local Authority (total number distributed in each council/sector)

Aberdeen	9	(12)	Inverclyde	5	(8)
Aberdeenshire	13	(16)	Lothians	1	(N/A)
Angus	6	(8)	Midlothian	5	(6)
Argyll & Bute	8	(10)	Moray	5	(8)
Borders	5	(9)	North Ayrshire	5	(10)
Clackmannanshire	3	(3)	North Lanarkshire	13	(26)
Dumfries & Galloway	8	(16)	Orkney	2	(6)
Dundee	7	(10)	Perth & Kinross	5	(9)
East Ayrshire	6	(9)	Renfrewshire	8	(12)
East Dunbartonshire	4	(9)	Shetland	4	(9)
East Lothian	3	(6)	South Ayrshire	5	(9)
East Renfrewshire	5	(7)	South Lanarkshire	11	(21)
Edinburgh	12	(23)	Stirling	4	(7)
Falkirk	7	(8)	West Dunbartonshire	5	(7)
Fife	13	(19)	West Lothian	5	(11)
Glasgow	16	(28)	Western Isles	3	(10)
Highland	21	(28)	Independent	17	(37)
Total				249	(417)

Sharing Ideas

		Strongly agree	Agree	Disagree	Strongly disagree	No response
1.	Opportunities for teachers from different schools to share ideas have reduced in recent years	41%	43%	16%	-	1%
2.	There are sufficient opportunities for teachers from different schools to share ideas	2%	15%	56%	26%	3%
3a.	There is adequate opportunity for Maths departments to meet with SQA	2%	19%	54%	24%	2%
3b.	Such meetings would be valuable	39%	58%	2%	<1%	3%

'Little opportunity for meetings between primary and secondary schools even associated primaries. Where there are opportunities getting cover for time out is difficult'

'No external networks operating currently, like reinventing the wheel with everyone operating in isolation'

'SQA seminars offered over the last few years to discuss Higher Maths have been excellent; the same thing for credit and Intermediate 2 would be good'

Support

		Strongly agree	Agree	Disagree	Strongly disagree	No response
4.	The Advisory Service no longer provides adequate subject support for Mathematics	53%	31%	13%	3%	9%
5.	I feel isolated with nobody offering direction in Mathematics	15%	39%	41%	6%	3%

'With no advisory service no-one is organising events regionally so national events such as Stirling Maths Conference are now seriously over-subscribed'

'The in-service days that do exist have been hijacked for generic issues because nobody in the local authority has knowledge or responsibility for promoting maths issues'

'Advisory service is top heavy with management/quality assurance officers so absolute minimum of support to schools at any subject level'

'Very few maths in-service courses. Within the region, we have set up local support group to organise CPD courses with view to networking time being given. East of Scotland Maths Association is up and running again'

Future Direction of Maths Education

		Strongly agree	Agree	Disagree	Strongly disagree	No response
6.	Mathematics Education in Scotland is being driven forward in a thoughtful positive way	<1%	22%	57%	20%	6%
7.	I feel optimistic about the future of Mathematics Education in Scotland	1%	32%	55%	12%	3%

'The direction offered should be from people with expertise in the area of maths education'

'Maths education is changing but not in a structured way, nobody thinking long-term and in a planned way. Ideas brought in but not thought through, as the 'ideas' people are not at the chalk-face dealing with pupils'

'There seems to be no driving force in Scotland. Any new initiative seems to be imposed by government or SQA'

'New [Faculty] Head not a mathematician, great at paper work but no experience of specific challenges facing maths teachers. No one with vision/new ideas and drive to take them forward'

National Qualification Framework

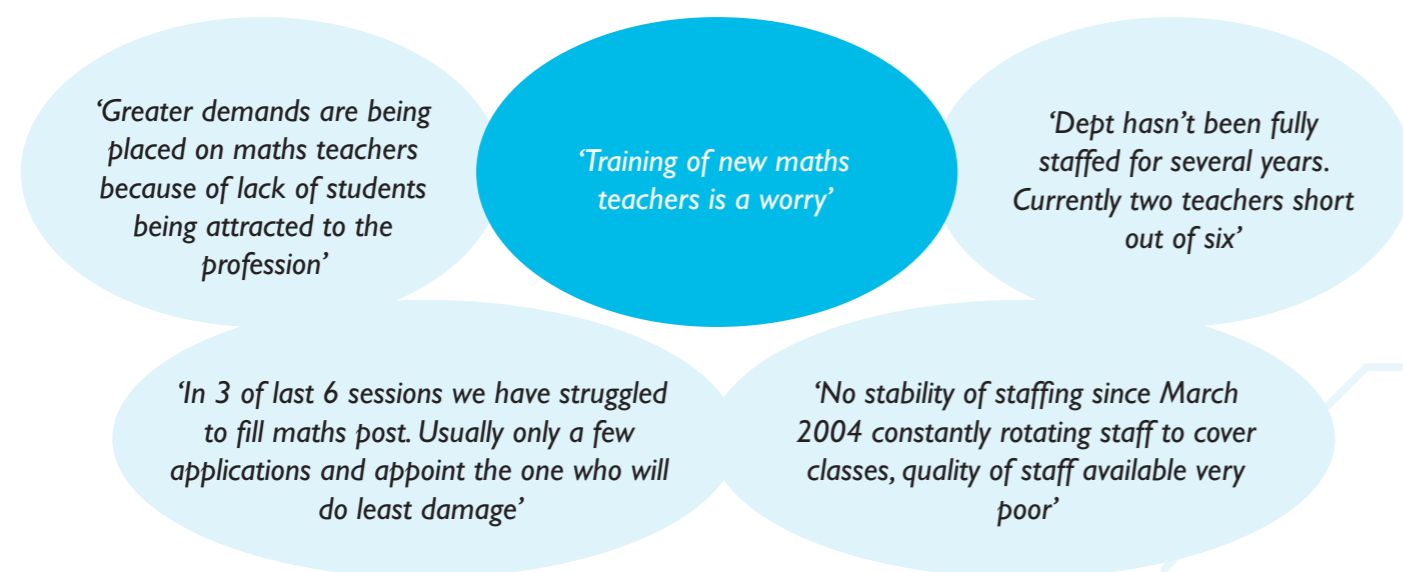
		Strongly agree	Agree	Disagree	Strongly disagree	No response
8.	Intermediate 2 is as good preparation for Higher as Standard Grade	4%	10%	34%	51%	2%

'Intermediate 2 exam poorly prepares for Higher. The exam tests little beyond the basic aspects with very little reasoning, application or integration of knowledge and skills - all essential for the potential Higher candidate'

'Suggested phasing out of S grade in favour of NQ is worrying. There is no safety net currently for NQ exams'

Teacher recruitment

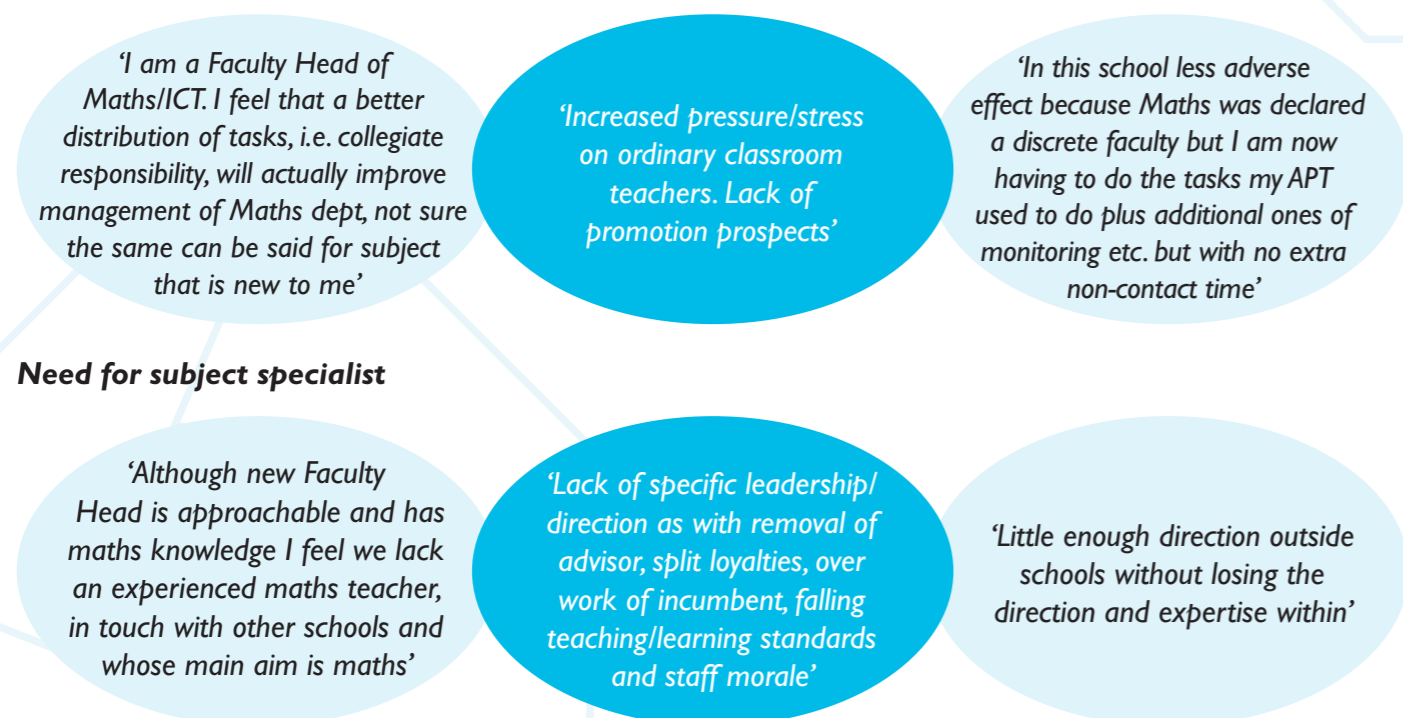
		Strongly agree	Agree	Disagree	Strongly disagree	No response
9.	My school has no experience of teacher recruitment shortages in Mathematics	5%	25%	32%	37%	1%



Faculty Head structure

Workload/Time

		Strongly agree	Agree	Disagree	Strongly disagree	No response
10.	Move to Faculty Heads will have no adverse affect on the management of Math Department	2%	21%	25%	51%	9%



Discussion

As noted, the purpose of this survey was to gather views on various issues affecting mathematics education in Scotland, from the perspective of the departmental, subject specialist, leaders. The findings should stimulate a timely debate, for the attention of Head Teachers and policy makers, as further changes to the curriculum are considered within the Curriculum Review 3-18, following the publication of *A Curriculum for Excellence* (2004).

The emerging issues of a perceived lack of leadership in developments and inadequate levels of support in taking forward initiatives and developments, especially at the subject level, have parallels south of the border. In England, concerns about the state of mathematical education led the Royal Society and the Joint Mathematical Council jointly to set up an Advisory Committee for Mathematical Education (ACME). The Minister for Education supported the initiative, which was funded by the Gatsby Foundation for three years. The government subsequently set up an inquiry into post-14 mathematical education chaired by Professor Adrian Smith FRS, vice-chancellor of Queen Mary University of London. Professor Smith's report, *Making Mathematics Count* (2004), presented a picture that identified points for concern in terms of mathematical education and its future provision in the UK. There is currently no overall supporting infrastructure to provide strategic direction and coordination, hence the current provision displays fragmentation, lack of coherence and gaps in CPD provision. The Smith report endorsed the ACME group's recommendation to set up a National Centre for Excellence in the Teaching of Mathematics (NCETM) in order to redress the current situation and to provide appropriate leadership, direction and CPD in an area of the profession that has particular difficulties with recruitment and retention. In addition to the National Centre (NCETM), there was a call for Regional Mathematics Centres (RMCs) to encourage the formation of local communities of teachers of mathematics and relevant stakeholders. The recommendation in the Smith report was for the introduction of RMCs:

to be located one in each of the 9 English regions as defined by RDAs³, with possible additional centres in Wales, Northern Ireland and Scotland

Although the Smith report is primarily concerned with developments in England and Wales, many of the issues have parallels in Scotland that would suggest the need for a comparable initiative to address the concerns. One of the central tenets of the Smith report concerned the training and continuing development of mathematics teachers, through CPD on subject matter, general pedagogical issues and subject specific pedagogical skills.

The general feeling appears to be that the situation in Scotland is healthier, particularly highlighted in the CPD component of *A Teaching Profession for the 21st Century*. The findings in this survey suggest there is scope for more subject development with staff in schools, supported at a local and national level. The loss of dedicated subject advisers is identified as a major blow, but respondents also view the lack of subject leadership in schools, where there are Faculty Heads appointed instead of principal teachers of mathematics, as another factor in limiting the necessary development of new and existing staff. Certainly there is not, as yet, the chronic shortage of qualified specialist teachers experienced south of the border but recruitment is beginning to present new difficulties.

The SMC has been concerned about the lack of leadership and strategic overview of mathematical education for some time. These concerns led to a subgroup meeting with representatives of the Scottish Executive to express those views. In 2002, the Executive appointed a Numeracy Development Officer on a seconded 2-year appointment with a remit that seemed to the SMC to be unrealistic; in fact, the appointment lasted only a year. A further year down the road another attempt to provide the necessary strategic leadership through Learning & Teaching Scotland (LTScotland) has led to the appointment of a part-time secondment to lead Numeracy developments. The piecemeal approach of 'project funding' does not give a lot of confidence to the profession with the perception that mathematics, under the name of 'numeracy', is not regarded as a core function of LTScotland. The nature of the appointments provide limited security or permanence either for the

³ Regional Development Agencies

individual to become fully integrated into the strategic developments or for the profession who can be left, at short notice, without any strategic leadership. The work of the 32 Councils appears to lack coherence, with 'national' decisions being taken at 'local' level, through networks of Principal Teachers where the Authority no longer has a subject specific appointment to lead the mathematics education developments.

Policy makers should seriously consider closer involvement with the developments south of the border, buying in to the networks that are being developed with the prospect of securing a Regional Mathematics Centre as suggested in *Making Mathematics Count* (Smith, 2004). The Scottish educational system is well placed to contribute to as well as benefit from closer involvement with the National Centre (NCETM) proposed in England.

More recently, the Association of Advisors in Scotland and a recently formed group comprising members of the Edinburgh Mathematics Society (EMS) and SMC representatives, has voiced similar issues to those outlined above. In addition, they are keen to improve the links between Secondary Education and Higher Education (HE) with a shortage of suitably qualified students entering the mathematics and science courses in the HE sector.

In conclusion, the SMC believes that anyone interested in the teaching of mathematics in schools and beyond will find matters of concern in this report. It invites The Scottish Executive to address these concerns in order to provide the support, leadership and direction required to ensure the flourishing of mathematics education in the 21st century.

If you have any comments or further contributions to make to the issues raised, please direct your correspondence to:

Sally Crighton, Secretary to The Scottish Mathematical Council, The Open University in Scotland, 10 Drumsheugh Gardens, Edinburgh EH3 7QJ

This summary, of an article originally published in SMC Journal 34 (2005), has been compiled by Tom Macintyre, editor of the Council's Journal. Fuller details on the work of and publications from the SMC can be found on the Council's website at:

www.scot-maths.co.uk

