

An overview of mathematics education (3-18) in Scotland

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This short paper sets out the different approach to mathematics education in Scotland, including the Curriculum for Excellence, Scottish qualifications and teacher education.

Keywords: mathematics curriculum; mathematics qualifications; Scotland.

Context

Education Scotland is a Scottish Government executive agency charged with supporting quality and improvement in Scottish education, thereby securing the delivery of high-quality learning experiences and outcomes for Scottish learners of all ages. Education Scotland works in partnership with local authority staff and other stakeholders to support collaboration and improvement within each region. Education Scotland operates independently and impartially, whilst remaining directly accountable to Scottish Government ministers. Education Scotland HM Inspectors, work across all areas of learning to support and challenge the work in Scotland's thirty-two local authorities, through the process and impact of rigorous inspection.

The Scottish Qualifications Authority (SQA) is Scotland's national awarding and accreditation body. SQA is responsible for the accreditation and award of qualifications. SQA's accreditation duties include recognition of qualifications (with the exception of degrees) and approval of awarding bodies. As an awarding body, SQA develops, validates and assesses qualifications, ensures quality education and training for learners taking its qualifications and certificates candidates.

Within Scotland thirty-two local authorities operate and deliver public services within their locality. Under statutory duty local authorities are required to ensure that there is adequate and efficient provision of school education in their area. As part of this requirement local authorities are responsible for taking forward nationally agreed policies and guidelines, for the spending and accountability of educational funding and for the continuous improvement of services to meet the needs of their local communities. Across Scotland, local authorities adopt different service structures. Increasingly, education is part of a wider department, which can also include services such as leisure, culture, sports, the arts, community learning and social work.

In June 2017, the Scottish Government published 'Education Governance – Next Steps' setting out its vision of an education system centred around children and young people and announced plans to promote, support and encourage local authorities to cooperate more closely. In response, local authorities aligned themselves into six Regional Improvement Collaboratives (RICs) to support inter-authority networking across Scotland. A joint agreement between the Scottish Government and the Council of Scottish Local Authorities (COSLA) on school empowerment, collaboration, parental involvement and engagement and pupil participation was published in June 2018.

Curriculum for Excellence

The Curriculum for Excellence (CfE), the curriculum taught in Scottish schools, sets out an entitlement for all learners. It is divided into two phases: the broad general education and the senior phase. The broad general education begins in early learning and childcare (at age 3) and continues to the end of S3 (the third year of secondary school). Its purpose is to develop the knowledge, skills, attributes and capabilities of the four capacities of the Curriculum for Excellence:

- Successful learners
- Confident individuals
- Responsible citizens
- Effective contributors

The Curriculum for Excellence (CfE) is designed to provide the breadth and depth of education to develop flexible and adaptable young people with the knowledge and skills they will need to thrive now and in the future. It aims to support young people in achieving and attaining the best they possibly can. A number of key documents were produced to support the effective implementation of CfE:

- Principles and Practice Papers – These documents are essential reading for practitioners as they begin, and then develop, their work with the statements of experiences and outcomes.
- Building the Curriculum Papers– This document series provides advice, guidance and policy for different aspects of CfE including assessment of the curriculum areas and developing skills for learning, life and work.
- CfE Briefings - A series designed to provide practitioners with information and advice to support their implementation of CfE.

Learning and Assessment in the Broad General Education

There are eight curriculum areas: expressive arts, health and wellbeing, languages (including English, Gàidhlig and Gaelic learners and modern languages), mathematics, religious and moral studies, sciences, social studies and technologies. The delivery of literacy, numeracy, and health and wellbeing across learning are the responsibility of all teachers. Each curriculum area is planned using [experiences and outcomes](#). These describe the knowledge, skills, attributes and capabilities of the four capacities that young people are expected to develop. [Curriculum for Excellence Benchmarks](#) set out clear statements about what learners need to know and be able to do to achieve a level across all curriculum areas.

A variety of assessment approaches are used to ensure learners demonstrate their progress through the levels and enable them to demonstrate their achievements in a range of ways appropriate to learning. For learners to demonstrate they have achieved a level, they need opportunities to show they:

- have achieved a **breadth** of learning across the experiences and outcomes for an aspect of the curriculum
- can respond to the level of **challenge** set out in the experiences and outcomes and are moving forward to more challenging learning in some aspects
- can **apply** what they have learned in new and unfamiliar situations.

Assessment is integral to learning and teaching and is an ongoing process. School children in P1, P4, P7 and S3 complete online standardised assessments ([Scottish National Standardised Assessments](#)) in literacy and numeracy. The assessments are taken once within the year and help to identify children's progress,

providing diagnostic information to support teachers' professional judgement. The timing of the assessment is determined at local level and due to the adaptive personalised nature of the testing approach, there is no pass or fail. The assessments are as inclusive as possible to accommodate the needs of children and young people who require additional support. Children and young people do not have to revise or prepare for these assessments. Ongoing and periodic assessments are, and will continue to be, the main basis of teachers' professional judgement. Teachers continue to draw on all of the assessment information available to them when considering children's progress and when planning next steps in learning. Professional judgements in relation to achievement of the Curriculum for Excellence levels is gathered on an annual basis by Scottish Government.

Learning, Progression Pathways and Assessment in the Senior Phase

In the senior phase (S4 to S6, age 16-18) young people build up a portfolio of qualifications. The curriculum in the senior phase comprises more than programmes that lead to qualifications. There is a continuing emphasis on health and wellbeing including physical activity and opportunities for personal achievement, and practical experience of the world of work.

The Scottish Government published [The 15-26 Learner Journey Review](#) in 2018. The review emphasises there is no wrong pathway for young people; everyone's learner journey is different. Learners in Scotland have the opportunity to undertake a flexible curriculum in the Senior Phase where they can complete a range of courses potentially at different levels. Neither the Scottish Government nor SQA specify the number of qualifications that a school should deliver. The number of subjects that learners study is decided by the particular school or local authority. There is a wide variety of qualifications available, as well as the graded National Courses: National 5 (N5, similar to GCSE grades 4 - 9), Higher (similar to AS level) and Advanced Higher (similar to A level), there are National Courses available at SCQF levels 1 to 4, Skills for Work courses, National Progression Awards (eg in Data Science), National Certificates, Foundation Apprenticeships and various other awards (eg Higher Statistics, Personal Finance, STEM leadership, Scottish Baccalaureate). Whilst the vast majority of young people complete graded National Courses, schools are increasingly broadening their curriculum offer in the Senior Phase and selecting qualifications that are most suitable for recognising their learners' achievements.

The vast majority of these qualifications are internally assessed, with SQA verifying the work of selected centres annually. Only graded National Courses are externally assessed through a variety of coursework and performance tasks and examinations. Mathematics is unique in that assessment is through timed written exam only. Most courses include both a calculator and non-calculator paper, except the Advanced Highers Mathematics of Mechanics and Statistics.

SQA's Mathematics provision

The progression routes through SQA's Mathematics courses are summarised in figure 1. The participation figures are given in Table 1. Whilst Scotland's participation in Higher Mathematics is very healthy, compared with the rest of the UK, it is much lower than Higher English. Consequently, SQA has worked with teachers, lecturers and industrialists to develop a new [Higher in Applications of Mathematics](#) that is intended to increase participation in mathematics at Higher and is suitable for progression from both Mathematics and Applications of Mathematics at National 5.

The course assessment includes a statistics project and an exam in which candidates are expected to make use of digital technology. The new progression routes are shown in figure 2. The new course is available for first teaching in 2021, with first awards in 2022. It is distinct from the current Higher in that it expects the use of technology throughout (spreadsheets and R) and includes statistics, finance and modelling as opposed to calculus and trigonometry.

Figure 1: Current progression routes through SQA Mathematics courses

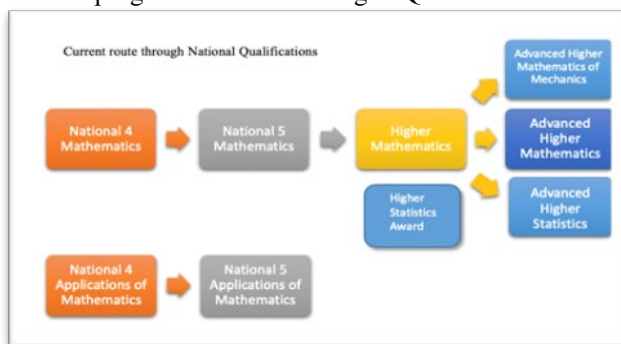


Table 1: Participation in SQA Mathematics courses 2020 (2019, 2018)

	Total	Female (%)	Male (%)
N5 Mathematics	41 282 (41 590, 42 191)	52.3 (52.8, 52.5)	47.7 (47.2, 47.5)
N5 Applications of Mathematics	10 428 (4458, 2482)	50.6 (53.2, 53.2)	49.4 (46.8, 46.8)
H Mathematics	19 182 (18 626, 18 753)	47.3 (47.5, 48.3)	52.7 (52.5, 51.7)
AH Mathematics	3635 (3706, 3683)	40.1 (41.1, 38.5)	59.9 (58.9, 61.5)
AH Mathematics of Mechanics	318 (294, 304)	19.8 (20.7, 23.0)	80.2 (79.3, 77.0)
AH Statistics	183 (212, 186)	36.1 (41.0, 44.6)	63.9 (59.0, 55.4)

Figure 2: Progression routes through SQA Mathematics courses from 2021



The participation rates for mathematics courses are relatively stable, except for N5 Applications of Mathematics (AoM). When first introduced, it was widely perceived as a course for lower attainers, as there is no algebra or trigonometry. Rather the emphasis is on everyday use and application of mathematics including statistics and finance. However, where content is common eg fractions, compound interest, reverse percentages the demand is identical. Both N5 courses are accepted for entry to further study and professional courses eg teaching and nursing. However, entries have increased substantially over the past few years as centres realise it is an

attractive alternative to N5 Mathematics for learners who are not intending to progress to Higher Mathematics and for higher attainers, where with relatively little additional teaching teachers who develop problem solving and application alongside mathematical techniques find their learners can be successful in both.

Table 2: Attainment rates in SQA Mathematics courses 2020 (2019, 2018)

	A-C (%)	A (%)	Female A-C (%) Male A-C (%)	Female A (%) Male A (%)
N5 Mathematics	79.1 (65.5, 64.7)	36.8 (30.9, 31.4)	80.3 (65.8, 65.0) 77.8 (65.2, 64.3)	36.9 (30.9, 31.2) 36.6 (30.9, 31.7)
N5 Applications of Mathematics	75.3 (58.5, 57.8)	28.9 (23.8, 18.5)	74.6 (56.5, 57.3) 76.0 (60.7, 58.3)	28.3 (22.3, 19.0) 29.6 (25.6, 18.0)
H Mathematics	83.3 (72.4, 74.5)	40.6 (32.9, 33.5)	85.7 (74.6, 76.6) 81.1 (70.4, 72.6)	42.3 (33.6, 33.9) 39.1 (32.2, 33.1)
AH Mathematics	89.2 (75.4, 74.7)	47.9 (37.2, 37.4)	91.6 (77.5, 78.6) 87.6 (73.9, 72.3)	51.9 (38.6, 41.2) 45.2 (36.3, 35.1)
AH Mathematics of Mechanics	92.5 (76.8, 79.9)	65.4 (40.8, 50)	95.2 (82.0, 90.0) 91.8 (75.5, 76.9)	65.1 (44.3, 54.3) 65.5 (39.9, 48.7)
AH Statistics	89.6 (77.8, 77.4)	53.5 (33.0, 37.1)	93.9 (78.2, 78.3) 87.2 (77.6, 76.7)	59.1 (36.8, 38.6) 50.4 (30.4, 35.9)

Approximately 20% of the candidature for N5 AoM is dual entry. This increase in entries of stronger candidates is reflected in the attainment rates shown in Table 2. Prior to 2020, when due to the Covid-19 pandemic teacher estimates were certificated, attainment had been relatively stable across all other courses. Whilst more girls than boys are entered at N5, at Higher slightly more boys take Mathematics and at Advanced Higher, the proportion of girls falls considerably (Table 1). On the whole girls outperform boys, except at N5, where boys perform better than girls in AoM and the proportion of grade A is similar or the same for Mathematics (Table 2).

Becoming a teacher in Scotland

Eleven institutions across Scotland deliver a growing number of Initial Teacher Education programmes with a wide range of [pathways into the profession](#). All teachers in Scotland have either completed a four-year undergraduate course in education, completed an undergraduate course and then a one-year PGDE, or have qualified outside of Scotland with equivalent qualifications. The [General Teaching Council for Scotland](#) maintains the register of teachers and plays a significant role in shaping Scotland's teaching profession, maintaining and improving professional standards, and contributing to the development of teacher professionalism and Scottish education. Newly qualified teachers must complete a probationary period before they become fully registered to teach in Scotland. This can be completed either through the [Teacher Induction Scheme](#) or through the [Flexible Route](#).

Career Long Professional Learning

The Professional Learning and Leadership directorate within Education Scotland has strategic responsibility for ensuring high quality professional learning for education professionals across Scotland. In Scotland significant work has been undertaken to develop a shared understanding of what good professional learning looks like and how it should be developed to have the greatest impact. Partners and stakeholders across the system have adopted a [national model of professional learning](#), which

builds on international research. The [Enhancing Professional Learning in STEM](#) Grants Programme provided £1.3million of funding in session 2019-20 to increase access to STEM learning opportunities and build practitioner confidence across Scotland. Professional learning opportunities focus on the sciences, mathematics and numeracy, interdisciplinary STEM approaches and digital learning, teaching and engineering technologies.

The importance of high-quality Career Long Professional Learning, specifically aligned to numeracy and mathematics, is noted within the final report of the Making Maths Count Group: [Transforming Scotland into a maths positive nation](#). In response to the recommendations detailed within this report, a national profile raising agenda has been established within Scotland that involves close partnership working with practitioners working at all levels of the Scottish education system To complement this work, in 2019 Education Scotland engaged in a system-wide thematic inspection of mathematics in schools: [Multiplying skills, adding value - Numeracy and mathematics for Scotland's learners](#).

More generally, teachers in Scotland are required to engage in professional learning, self-evaluate this learning against the [GTC Scotland Professional Standards](#), and maintain a record of this learning. Teacher's annual Professional Review and Development discussion forms part of this process. In addition, as part of a five-year cycle, all fully registered teachers in Scotland are required to complete a Professional Update process in partnership with the GTCS in order to maintain full registration.

Conclusion and looking forward

Compared to the rest of the UK, Scotland has a distinctive approach to education as illustrated in this short paper. Despite the aspirations and provisions described, Scottish Government has commissioned [independent review led by the OECD](#) to understand how policy aims for curriculum and qualifications are being implemented, in partnership across schools, colleges, community learning and development and employers in Scotland, for the benefit of learners. A report is due in summer 2021. We look forward to being able to update you on what transpires.