

# THE LEARNED SOCIETIES' GROUP ON SCOTTISH SCIENCE EDUCATION

## AUGUST 2015

### THE WORK AND OUTCOMES OF THE SCOTTISH QUALIFICATIONS AUTHORITY (SQA): A RESPONSE TO THE SCOTTISH PARLIAMENT'S EDUCATION AND CULTURE COMMITTEE

- 1** The Learned Societies' Group on Scottish Science Education (LSG) welcomes the opportunity to make a submission to the Scottish Parliament's Education and Culture Committee in relation to its scrutiny of the SQA's work and outcomes. We have restricted our response to issues relating to SQA's contribution to education policy, through its management, leadership, development and delivery of the new national qualifications. The LSG's focus is on the developments in science (including computing science) and mathematics. Aspects of our response might also be applicable to the Committee's consideration of other education-related public bodies in Scotland, including Education Scotland.
- 2** The LSG comprises representatives from the: Association for Science Education; BCS, The Chartered Institute for IT; Edinburgh Mathematical Society; Engineering Policy Group in Scotland; Institute of Physics; Royal Society of Biology; Royal Society of Chemistry; Royal Society of Edinburgh; and Scottish Mathematical Council. The establishment of the LSG has purposes arising from concerns about, and a need to contribute to, the major reforms in the delivery of science and mathematics education in Scottish schools. It was recognised that while the constituent organisations are individually active in this area, there is added value from a collaborative grouping that identifies, discusses and takes action on common issues.
- 3** We are pleased to have had the opportunity to engage with the Committee on our work, notably in relation to the research<sup>1</sup> which the LSG commissioned last year on the resourcing of science in Scottish primary and secondary schools. It might be of interest to the Committee to see the range of specific activities to promote STEM education in Scotland which are supported by the LSG organisations. This is attached, separately.
- 4** Drawing upon the links it has with networks of teachers, the LSG has engaged constructively with the SQA in relation to the implementation of the

national qualifications and assessment. This includes members of the LSG meeting with senior officials from SQA in June 2014 to discuss how concerns about the new national qualifications in the sciences could be addressed. A number of LSG representatives are also participating on the SQA's National Qualification Support Teams. The SQA has also been invited to contribute to the national action group on interdisciplinary learning, which is supported by the LSG and the STEM Education Committee (STEMEC).

- 5** The LSG has indicated, and should like to reiterate, that it would be pleased to meet more regularly with SQA officials to consider how best the LSG can support the science and mathematics' qualifications.

### Implementation of the Qualifications' Reforms

- 6** The LSG recognises that SQA has, by and large, met the deadlines associated with the implementation of the new qualifications and assessment. We also recognise that it has not had unilateral control over the implementation timetable, given that the Curriculum for Excellence (CfE) reforms have been developed in association with Scottish Government, Education Scotland and other organisations represented on the CfE Management Board. We appreciate that the implementation process has been challenging, particularly as the SQA has had to deliver so rapidly a National Qualifications system without any piloting. It has also had to manage the complexity of the range of qualifications available during the transitional period of the CfE reforms.
- 7** Last year the LSG undertook brief survey enquiries<sup>2</sup> on schools' science curriculum arrangements and also explored how science teachers were responding to the curriculum and assessment reforms. While the matters explored in the survey extended beyond the qualification reforms, they were a prominent feature of the responses.

<sup>1</sup> <https://www.royalsoced.org.uk/news/news.php?id=263>

<sup>2</sup> [https://www.royalsoced.org.uk/1076\\_LearnedSocietiesGrouponScottishScienceEducation.html](https://www.royalsoced.org.uk/1076_LearnedSocietiesGrouponScottishScienceEducation.html)

**8** While the survey responses indicated general appreciation and support for the principles of CfE and reform of the qualifications, including the necessary updating of science courses, the *processes of change were heavily criticised* as being incoherent and rushed, causing stress among teachers and pupils resulting in low motivation for the development of new approaches.

**9** Survey responses relating to the reform of the qualifications can be summarised, as follows:

- The reforms' *implementation was criticised* as lacking adequate resources, effective management or proper trials.
- *Assessment requirements were seen as ineffectual*: poorly explained, inadequately implemented nationally and undermining the confidence of both staff and pupils in contrast with memories of helpful support packages at the start of Standard Grade.
- *The resources provided were considered too few, too unwieldy and too late*, and information on assessment and qualifications often lacked meaningful advice, consistency and clarity.
- Concern about the *burden and excessive time taken by internal assessment*. Teachers were concerned about the time available for teaching and learning, the impact on practical work, formative assessment techniques and science's 'wonder'.
- There was anxiety about *losing the 'ethos of certification for all'* and worries about reintroducing pass-fail measures without external assessment at N4. This tended to reduce the currency of N4 outside school and devalue the courses in pupils' eyes. Parents were reported as pressing for presentation at N5.
- Many schools were uneasy about *leaving subject choice too late*.
- While the majority of teachers indicated they were *confident* about teaching the N5 science courses to a class of N5 candidates; 57% were *not confident* about teaching bi-level N4/N5 classes as were 69% with N3/N4/N5 tri-level groups.
- Almost all teachers were confident of *understanding the SQA assessment procedures*. However, only 3% indicated they were very confident about the *required breadth and depth of N5 course content for examination purposes*; 67% were either not at all or not very confident.
- Doubt was expressed about the extent to which the *early stages of CfE provide adequate preparation for senior phase qualifications*.

## SQA Responding to Feedback from the Teaching Profession

**10** We recognise that SQA encourages feedback from teachers and continues to take action where matters have been brought to its attention. We also appreciate that SQA continues to provide advice and support to schools and teachers in implementing the new qualifications, including having organised a range of training days for the sciences. We are aware that SQA has taken action to address issues highlighted in the survey, particularly in relation to seeking to reduce the assessment burden. We recognise that in response to feedback, SQA has updated course documentation and removed and consolidated some of the assessment standards. Changes made to course and assessment documentation are notified in one area of the SQA website to improve the communication of changes to course documentation to teachers. Last year science teachers had indicated to the LSG that too many changes, made too quickly, resulted in them following out-of-date versions, ultimately, unsettling their confidence in the reforms. In response to a suggestion from the LSG, SQA agreed to hold-over changes so that they are now made at regular intervals which teachers are familiar with.

**11** While the LSG welcomes the action that SQA has taken in responding to feedback, we have expressed concern about the reactive nature of these interventions. Fundamentally, it is apparent to us that a strategic approach to the implementation programme for the CfE and qualifications' reforms has been lacking. This, of course, extends beyond SQA and is a challenge to the CfE Management Board. Notably, no independent evaluation has been undertaken or planned for, that would enable an assessment to be made of whether the reforms "*have made any difference*". We therefore do not have a proper understanding of these important reforms and how to improve the system.

**12** Practitioners and learners have been able to submit formal feedback on courses and assessment through the SQA's annual National Course Assessment Survey. This web-based survey was last undertaken in 2014, generating responses from 1250 practitioners and from 1317 learners. SQA published a summary of the results in June 2015<sup>3</sup>. We understand that SQA is seeking to move towards a more representative and reliable system for enabling teachers and learners to provide assessment-related feedback. Despite its limitations, the survey has enabled practitioners and learners to respond formally and encouraged openness in the process.

**3** [http://www.sqa.org.uk/sqa/files\\_ccc/2014NationalCourseAssessmentSurveySummaryResults.pdf](http://www.sqa.org.uk/sqa/files_ccc/2014NationalCourseAssessmentSurveySummaryResults.pdf)

In 2014 the subjects with the highest numbers of practitioner responses included Chemistry, Physics, Biology and Mathematics. The results showed that 63% of Physics, 58% of Chemistry, 58% of Biology and 34% of Mathematics practitioner respondents rated the course assessment as being unfair. It is important that SQA is able to consider and act upon responses offered. We are therefore keen to ensure that practitioners and learners continue to be able to submit formal feedback on qualifications and assessment. The Committee might therefore consider enquiring with SQA as to what new provision is being made to formally capture the views of teachers and learners.

- 13** We have praised SQA for the way in which it has encouraged and acted upon feedback. However, we were concerned to learn that it has not responded to a letter which was submitted to it in February by Heads of Chemistry of independent schools. Their letter, which was made available to the LSG, draws together many of the same concerns which the LSG received to its survey. As well as articulating concerns about courses and assessment, in their letter the Heads of Chemistry have proposed how some of the challenges could be overcome. We believe it is important that SQA should ensure that it engages timeously with constructive approaches such as this.
- 14** We are very supportive of the online teacher networks for Biology, Chemistry, Computing and Physics among others, which enable teachers to share insights, experiences and innovative materials. However, this should not replace the requirement for well-planned, high quality, timely exemplars and resources to support qualification developments. We have been concerned that teachers have had to compensate for a deficit in high-quality assessment materials by developing their own, often at very short order, to meet their immediate needs. We are aware that the SQA commissioned the Scottish Schools Education Research Centre (SSERC) to produce resource packs to support the Higher Assignment in Biology, Human Biology, Chemistry and Physics. We would support further activity of this kind.

## Implications of the New Qualifications for the Sciences and Mathematics

- 15** The LSG continues to monitor the implications of the national qualifications on the uptake and attainment in the sciences and mathematics. In doing so, we have undertaken some preliminary analysis of the SQA Attainment Statistics<sup>4</sup> published in August 2015. The LSG recognises that the new qualifications will need to run for a number of cycles before any trends can be drawn.

- 16** While the curriculum models employed by local authorities and schools are not the responsibility of SQA, it is important that the CfE Management Board remains vigilant to unintended consequences that might occur. A prominent example of this relates to the number of qualification courses that can be taken by learners in S4. While it is not the result of any conscious policy decision, the LSG is concerned about the potential for narrowing of the curriculum and the implications for study in the sciences in the senior years at school.

### SCQF Levels 4 & 5 – National 4/5, Intermediates and Standard Grades

- 17** The number of candidates presenting for the sciences and Mathematics has declined between 2013 (last year of Standard grades) and 2015. Over this period Computing-related (which includes Information Systems) presentations are down by 29.3%; Engineering-related (which includes Technological Studies) are down by 13.3%; Chemistry is down by 11.3%; Biology is down by 7.9%; Physics is down by 4.8%; and Mathematics is down by 3.5%.

### SCQF 6 – New and Existing Higher

- 18** Between 2011 and 2015, computing-related aside, there has been an increase in the number of Higher entries in sciences and Mathematics, with an increase of 5.8% in Chemistry; 3.5% in Physics; 2.5% in Mathematics; and 1.4% in Biology over this period. Computing-related (including Information Systems) presentations declined by 15.5%.
- 19** However, we note that between 2014 and 2015 the number of Higher entries decreased in the sciences and mathematics. Computing-related presentations are down by 15.4%; Chemistry is down by 4.6%; Physics is down by 4.2%; Biology is down by 4.1%; and Mathematics is down by 3.6%.
- 20** The circumstances surrounding the new Higher Mathematics examination and the setting of the pass mark at 34% has inevitably generated considerable comment. However, in the absence of independent evaluation of the full circumstances there is no definitive way of determining why things transpired as they have done. A range of factors (and their relationship to one another) would need to be fully considered, including question paper difficulty; the way in which the questions were framed (and interpreted); learners' preparedness for the examination; the circumstances surrounding the operation and experience of the examiner and setting team; and the quality assurance processes; among others.

### SCQF Level 7 – Scottish Science Baccalaureate

- 21** The Scottish Baccalaureate in Science (which has the highest uptake among the four Scottish Baccalaureates) was launched in August 2009.

<sup>4</sup> SQA Attainment Statistics (August) 2015: <http://www.sqa.org.uk/sqa/64717.html>

In 2012, there were 151 entries, declining to 142 in 2013, down to 136 in 2014 and then to 92 in 2015. Its purpose is to promote the importance of science, to raise the status and value of S6, to be a valued qualification for entry to higher education and to be a bridge between school and what follows. However, the low level of entries indicates that the Baccalaureate does not carry sufficient currency among learners, teachers, parents, universities and employers to make it an attractive enough proposition. To its credit, it does formally recognise interdisciplinary learning (IDL) (the only SQA qualification which does so) through the IDL project, which is a mandatory component of the Baccalaureate. However, given its low and declining uptake, and issues relating to schools' ability to offer the qualification, there would certainly seem to be a strong case for reviewing the role of the Baccalaureate in Scottish education. It therefore remains the case that for the vast majority of learners no IDL is formally experienced in the Senior Phase.

### Difficulty of the Sciences and Mathematics Relative to Other Subjects

- 22** The SQA's guidance<sup>5</sup> on setting grade boundaries makes clear that SQA has to ensure that it is not easier or harder to achieve the same result across different courses. As an example, the guidance states, "a Grade B in Higher Chemistry should broadly represent the same standard of attainment as a Grade B in Higher French."
- 23** However, the SQA's Attainment Statistics show that there are in some cases quite marked differences among different courses in the number of pupils who achieve passes. In 2015, 61.8% of Mathematics, 70.7% of Biology, 72.5% of Chemistry and 74.1% of Physics candidates at National 5 achieved a pass (grade A-C). In comparison, 80% of Geography, 87% of English, 89.6% of French and 95.1% of Music candidates achieved N5 passes. This serves to indicate that it is more difficult to secure a pass in the sciences at N5 compared to a range of other subjects. We recognise that the underlying picture is more complex than these figures alone would suggest. We are however concerned about the implications of the perception that the sciences are more difficult in terms of influencing learners' senior phase course choices.

<sup>5</sup> [https://www.sqa.org.uk/sqa/files\\_ccc/A\\_Guide\\_to\\_Setting\\_Grade\\_Boundaries.pdf](https://www.sqa.org.uk/sqa/files_ccc/A_Guide_to_Setting_Grade_Boundaries.pdf)  
<sup>6</sup> [http://www.sqa.org.uk/files\\_ccc/SQA\\_Awarding\\_Body\\_Code\\_of\\_Practice.pdf](http://www.sqa.org.uk/files_ccc/SQA_Awarding_Body_Code_of_Practice.pdf)

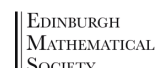
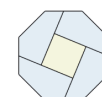
### Interdisciplinary Learning

- 24** A new, central and distinctive context for learning in CfE is *interdisciplinary learning* (IDL). There is accumulating evidence and argument to support the importance of IDL in imparting skills for learning, life and work, transferable and higher order skills, the relevance of learning to the world of work, and the capacity to engage disengaged learners. Employers seek school leavers and FE/HE graduates with these enhanced skills and attributes.
- 25** Major advances in STEM research typically occur at disciplinary interfaces, where progress depends on making interdisciplinary connections to gain new insights. Many commercially significant innovations and improvements across all workplace sectors are likely to result from the cross-disciplinary fertilisation of ideas.
- 26** As stated in paragraph 21, IDL is only formally recognised by SQA in the interdisciplinary project component of the Scottish Baccalaureate. However, an important consideration in embedding IDL in schools will be the recognition it is accorded in formal qualifications by SQA. Teachers and educators will look to SQA to provide leadership in IDL implementation.
- 27** We encourage the Committee to question SQA on what, if any, is its *strategy for IDL implementation and its assessment?* And, what framework or structures exist – or could be created – to embed IDL skills, values and principles into what currently persists as a small number of discrete disciplines (subjects) in the senior phase of Scottish education?

### Independent Evaluation

- 28** The need to independently evaluate the current reforms in Scottish school education, including the implementation of the new qualifications and assessment is crucially important, and is an underpinning theme of our response. SQA operates to a set of governing principles, of which Principle 12 states that, "SQA will ensure that its qualifications and assessment are open to evaluation by appropriate national and international bodies." In pursuance of this we firmly believe that an evaluation plan is required, particularly given the absence of pilot studies, to reflect on the qualification and assessment implementation process, the effectiveness of quality assurance procedures and the documentation produced. The evaluations and accompanying evidence base should be publicly available.

For further information about the Learned Societies' Group, contact William Hardie, Secretariat ([whardie@royalsoced.org.uk](mailto:whardie@royalsoced.org.uk))



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