# IOP Scotland response to the Scottish Government survey on education reform

**October 2023**

## First page

The survey is described as inviting views "on the final report of the National Discussion on Education and the final report of the Independent Review of Qualifications and Assessment." Accordingly, the independent review of the skills delivery landscape (the "Withers" review) is not part of the survey.

There is nothing to complete on the title page: respondents are invited simply to proceed to the next page of the survey.

## Page 2: National Discussion on Education

This page poses three questions, about short-term, medium-term and long-term priorities.

### 1. What is your top priority for a short-term action?

Because **subject-specific professional learning** is essential for high quality teaching and learning, there should be a systematic approach to developing teachers' subject knowledge for teaching, including a consistent national system of subject-specific professional learning within each subject which is integrated within the system, appropriately resourced, based on evidence-based practice, properly evaluated and which allows schools and teachers to plan for years ahead.

As a driver towards this, teachers should be entitled to have at least half of their allocated time for professional learning dedicated to subject-specific options. This should also form a significant part of any increase in non-contact time introduced in the current parliamentary session. We believe only a strong commitment across the system and the combination of these push and pull factors will spur the culture change needed across the sector which increases understanding of the value of subject-specific professional learning for pupils, teachers and the entire system. National agencies, education authorities and school leaders should be encouraged to read the Institute of Physics (IOP)'s "Subjects Matter" report (www.iop.org/about/publications/subjects-matter) and evidence (https://bit.ly/SubjectsMatterSco).

Subject-specific professional learning should also be secured for primary teachers. This is in some respects more important than at secondary level because primary teachers are necessarily generalists and there will surely be elements of the curriculum in which they have limited experience, and this is especially true for science. Uncertainty and comparative lack of knowledge undermine teacher confidence. Yet we know that interest in STEM thinking begins in infancy and that engagement and play is crucial to allow inherent tendencies to develop into lifelong STEM thinking skills (not specific knowledge, but dispositions such as curiosity, questioning, scepticism, assessment and analysis, and confidence and mindset not to be discouraged when encountering new information or challenges). Natural curious tendencies can be quelled by encountering fear, disapproval or absence of opportunity. Specific science learning for primary teachers can and does secure a much more nurturing environment for STEM learning within schools.

## 2. What is your top priority for a medium-term action?

All schools should adopt and implement a **whole-school approach to equity and inclusion**.

For decades, we have known that the world of physics is dominated by men and boys. Three out of every four Higher physics entrants is male. Yet girls show similar levels of interest and aptitude to boys until around the age of 14, when engagement drops significantly (though girls who pursue physics at Higher level consistently perform better than their male classmates).

Other key groups are also underrepresented because of disability, sexual orientation, poorer backgrounds or (in some cases) ethnic minority group. We see this more easily in England than in Scotland, as SQA does not currently publish data correlating subject choices with protected characteristics other than sex, but the trend is notable in developed countries around the world.

There are several adverse consequences of this: young with people with an interest in and affinity for a critical science are dissuaded from pursuing it and therefore deprived of opportunities for fascinating, well-rewarded and impactful careers. Society is also denied the talents and potential of thousands of young people to tackle our most pressing challenges. And less diverse organisations are more insular, make poorer decisions and are less able to understand the full impact of their work.

Research from the Institute of Physics (IOP) has shown that this imbalance is substantially caused by perceptions of physics as a subject, beliefs about whom the subject suits, and stereotypes and biases (often unconscious) about what young people from different groups are capable of. These perceptions are often shared and reinforced by those around the learners – families, communities and the media. That is why a concerted and co-ordinated approach is needed, and cannot just be limited to the physics classroom or lab.

The Improving Gender Balance and Equalities (IGBE) programme receives overwhelming support from teachers who have benefited from it. Schools can and should supplement this expertise by spreading its lessons through school life. Teachers, support staff, parents and pupils should be involved in this effort to tailor it to school circumstances and create buy-in, and then integrate the approach into school improvement processes. Schools and agencies should seek information and advice from the IOP's Limit Less campaign (www.iop.org/limit-less). The IGBE programme should be both retained and extended during the reform of national agencies.

## 3. What is your top priority for a long-term action?

There should be a proper review of the role of knowledge through the whole 3-18 curriculum and a redressing of the balance of knowledge and skills. This specific point was highlighted by the OECD and it is crucial to developing good outcomes for learners and for closing the poverty-related attainment gap.

Much of science knowledge is cumulative, and developing science skills (and physics skills specifically) depends to a large degree upon a sufficient grounding of knowledge. The curriculum should specify this much more clearly so that teachers in subsequent years can more effectively rely upon pupils' prior learning and build upon it. This would serve to promote a consistency of approach and also facilitate the "sticking" effect where new knowledge built upon existing knowledge is more easily retained and more effectively applied.

A knowledge-rich curriculum harnesses the power of cognitive science in relation to learning: when Finland adopted this approach it rose to the top of global rankings. Its adoption of more generic skills learning focused on creativity and communication has caused its position to slip. Skills and factors such as confidence are clearly important for attainment, but confidence does not exist in a vacuum – the greatest factor in instilling confidence in learning is firstly to know what one understands and why. Now that the Scottish Government has committed to re-joining international comparative programmes, it should follow through on the factors which demonstrably improve education systems. In confirming the importance of knowledge in curricula, we should follow the guidance proposed by the IOP in 2018 (https://spark.iop.org/framing-future-physics-curricula).

We should not narrow the number of subjects which pupils in S4 can study in the time available. This has adverse implications for changes in choices in subsequent years, specifically including the ability to keep studying a group of STEM subjects alongside some other subjects, which in turn reduces the ability for interdisciplinary learning in the Senior Phase.

## Page 3: Independent Review of Qualifications and Assessment (Hayward Review)

This page gives a summary of the 26 recommendations in the final report of the Hayward Review, namely:

- Adopt the **Scottish Diploma of Achievement** as the new approach to qualifications and assessment. The SDA (the Diploma) should contain three elements: Programmes of Learning, Project Learning and the Personal Pathway.
- **Personal Pathway**: Include the Personal Pathway element as a prerequisite for the award of the Diploma. It is an entitlement and must be available to all learners.
- **Project Learning**: Include the Project Learning element as a prerequisite for the award of the Diploma. It is an entitlement and must be available to all learners.
- **Programmes of Learning**: Should remain an important aspect of the Senior Phase and will be a prerequisite for the award of the Diploma. There should be a reduction in external assessment across the Senior Phase.
- **Assessment**: Reduce the number of external examinations in the Senior Phase; increase the breadth of assessment methods including digital assessment methods, and remove external assessment up to SCQF level 5.
- **Modularised Courses**: Programmes of Learning should be organised into modules to allow learners maximum flexibility to build credit as they progress through courses. SCQF Level 6 Higher courses should be progressive allowing learners to build credits over two years.
- **Digital**: All learners should have a digital profile to allow them to record achievements in Programmes of Learning, Project Learning and Personal Pathway. The profile will be owned by the learner. Digital technologies should be used to expand assessment methods.
- **Workforce and Professional Learning**: An expanded programme of professional learning should be developed to support the changes to qualifications and assessment. Time should be made available

for staff in Education to access professional learning, to collaborate and to engage with the changes being proposed. Build a national strategy for standards.

- **National Monitoring and Accountability systems**: Require national monitoring and accountability systems to gather information on the breadth of achievements recognised within the Scottish Diploma of Achievement. Insight and the National Improvement Framework (NIF) should be updated to reflect success as envisaged in the SDA.

- **Parity of Esteem**: Enhance Parity of Esteem between types of qualifications by recognising as equal all qualifications at the same SCQF level with the same credit points. Qualifications at the same level should Scotland, should use the SCQF Level followed by the name of the qualification in promotional literature and in recording of results for example, Chemistry - SCQF level 6 - Higher

## 4. Which recommendations in the final report do you believe are the most important?

We selected the **Programmes of learning**, **Project learning** and **Workforce and professional learning** options.

## 5. Tell us why you have selected these recommendations.

Programmes of learning – specifically curriculum areas in specific subjects – must remain a core feature of education, for reasons stated in answer to question 3 above. It is important that proportionate and fit-for-purpose assessment instruments are used in all programmes of learning. Recent curriculum development has insisted on a high level of commonality of assessment approach across all subjects (e.g. the framework for assessment in the CFE's *Building the Curriculum 5*). However, this has had adverse effects. In all major curriculum and assessment reforms during the last few decades within Scottish education, some of the assessments introduced initially have had to be amended and simplified as they proved overly complex and bureaucratic to administer and/or inequitable. These have included poorly designed basic competency assessments in subjects dominated by hierarchical knowledge, too many different individually assessed outcomes in poorly designed unit assessments, investigations subject to input from individuals other than the candidates themselves or alternatively done under examinations conditions reducing them to stressful activities unrepresentative of the real world situations they purport to represent, and external written examinations in practical subjects. Inevitably, if common assessment procedures are rigidly applied across the curriculum, some subject areas will lose out more than others, and we believe this has-previously had an adverse effect on the STEM subjects. George Santayana's aphorism about not learning from history and being doomed to repeat it is apt; mistakes can also be avoided by looking to international examples of other education systems. We can see no reason why approaches to assessment should be standardised across all subjects. The diversity that different subjects provide should be welcomed and celebrated and with this an appropriate range of assessment instruments used. Experts in assessment should work with leading voices in each subject, including professional associations and learned societies, to develop the right approach for each subject.

Project learning is vital for physics because it enables students to solve meaningful and authentic problems through enquiry, and practical experience of scientific concepts aids acquisition and retention of knowledge. Since it is routinely performed in pairs or groups, project learning typically fosters collaboration, which reflects the application of physics in industrial environments. Real-time feedback from peers and teachers helps develop self-reflection and adjustment. Project work should also begin

early, gradually blended into more direct or explicit teaching approaches so as not to form stumbling blocks if learners are expected suddenly to move from more receptive to more participative approaches. It can also be highly engaging and motivational, and promote interest in furthering a science career, which not only advantageous for the individual student, giving them access to inspiring, well-rewarded and in-demand roles; but is also important for society in an increasingly digitised and automated age, on the cusp of a fourth industrial revolution, with a strong and growing need for physics-based skills and knowledge to build a green economy and address climate change. A recognised role for project learning might also improve articulation routes through into both further and higher education for particular students. However, a recognised role for project learning has to meet certain standards to be effective, and by common consent among physics teachers, the current Higher assignments are not effective and indeed are not fit for purpose. A flexible model closer to the previous Researching Physics unit in Revised Higher Physics, which allowed for a wider range of methodologies rather than only through the production of externally assessed written reports, would be a much more positive and productive experience for many learners. There is also an opportunity to reduce unnecessary and demotivating duplication between different science subjects. Finally, project learning depends upon access to sufficient suitable equipment for practical work, including demonstrations and small group experiments– this is especially important in the physics curriculum, which requires much more bespoke equipment related to specific aspects of the curriculum than is the case in many other curriculum areas.

The workforce and professional learning element is essential to making any reform work in practice; this was sadly overlooked during adoption of the Curriculum for Excellence. The OECD highlighted that, ten years after implementation, still many of those relied upon to implement and deliver the curriculum were unsure of the respective roles of teachers, school leaders, local authorities, regional improvement collaboratives and national agencies. The sentiment that "all curriculum development rests on teacher development", expressed by the noted educational and curriculum theorist Lawrence Stenhouse in his book *An Introduction to Curriculum Research and Development* (1975), is correct. Any reform requires full acceptance of teacher professionalism and its implications, namely resourcing and supporting teachers to empower them to be more directly involved in curriculum-making and in assessment to achieve the principles and objectives of the reformed system, including access to sufficient accessible and good quality CLPL, and sufficient subject-specific professional learning to ensure teacher specialism. It also means sufficient resources to employ, value and integrate science technicians into school science departments.

## 6. Are there any recommendations which you disagree with?

We selected the **Personal Pathway** and **Digital** options. Although the IOP does not completely reject these options, there is no other way within the confines of the survey to note concerns about specific proposals from the Hayward Review.

## 7. Tell us why you have selected these recommendations.

The idea underlying the Personal Pathway proposal could have some merit, but it also risks exacerbating disadvantage for some school pupils and creating more work for teachers. Formal recognition of achievements outside of school or college has a potential appeal, but it could create additional pressure on learners to take on extracurricular activity, especially the kinds which can be measured and more easily lead to recognition (such as those organised by the uniformed organisations). Although described as an

entitlement, opportunities to take part in such extracurricular activities tend to be more easily available to pupils and families who are better off and can afford participation costs, travel and other expenses. It could also extend a pressure to achieve into extracurricular activities, when there are developmental reasons to believe that it is healthy to encourage children and young people to have external pursuits where the principal goals are not achievement but other benefits – health and wellbeing, social interaction, exploration and creativity – which are harder to record and quantify. Although it is proposed that learners record their own achievements on a digital profile, some verification is likely for the system not to be open to manipulation and circumvention. If the verification of external achievement falls upon teachers, it is hard to see how this would not create a bureaucratic burden on them.

Equally, use of digital technology for learning and assessment creates opportunities and will be increasingly necessary in a modern, flexible educational model, could be more inclusive for learners with special educational needs, will increase familiarity with online learning and so more closely reflect work-based professional learning through online modules. However, in integrating this into assessment practice, we should be aware of the current limitations of digital assessment which lend themselves towards automated analysis, namely multiple-choice rather than essay questions. The latter affords much more opportunity to demonstrate deep understanding and for assessors to discern the candidate's full understanding of the subject, rather than simply memorising answers, "teaching to the test", and the possibility of picking the right option by luck or the elimination of senseless alternatives. Any developments in digital assessment must also recognise the rapid developments taking place in AI and ensure that appropriate safeguards are in place.

## Page 4: About You

The Smart Survey was completed by IOP Scotland's Learning and Skills Manager on behalf of IOP and it was stated it was a group based on the inputs of approximately 32 people.

If you have any questions about the survey or the IOP's responses, please contact:

**Stuart Farmer**
Learning and Skills Manager
IOP Scotland
email: stuart.farmer@iop.org