THE EDUCATIONAL INSTITUTE OF SCOTLAND

EIS Submission to Consultation on a Strategy for Education & Training - SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS

1. Do you agree with the definition provided of STEM for the purposes of this Strategy?

◉ Yes ○ No

The EIS agrees with the definition though would highlight the need for care when using the term to acknowledge the diversity of the discrete disciplines that it encompasses.

2. Do you think the aims of this Strategy and the four priority themes are the right ones to address the challenges identified?

◉ Yes ○ No

The EIS view is that the aims of the strategy are broadly set in the right direction though would suggest that there should be additional elements covered within the statement of aims and would question how success will be measured.

Although identified as priority, equity should be central to the aims of the strategy given its relationship to the education and employment sectors, and the need for the alignment of Scottish Government policy aims.

The EIS would also recommend that the strategy should not simply address the 'uptake' of further STEM study and training for the purposes of 'gaining' employment. This, by implication, focuses on learners and employees while being silent on the responsibility of employers to promote STEM careers, to recruit and retain a wholly diverse workforce, and to ensure equality in terms of career progression and pay. The gender pay gap remains at 14.9% in Scotland and, while the number of female STEM graduates is improving, recruitment, progression and retention rates within these careers continue to lag.

There are also issues that STEM employers require to address with regards to socio-economic and ethnic backgrounds. Research conducted recently by the London School of Economics and University College London highlights significant under-representation of individuals from working class backgrounds in STEM professions such as medicine and a sizeable pay gap of £10,218, between workers from more and less affluent backgrounds. Within information technology the pay gap sits at £4,736. The research identified that such pay gaps were in part caused

by differences in educational background though even when professionals had the same educational attainment, role and experience, those from poorer families were paid an average of £2,242 less. The study also found that employees from black and minority ethnic professionals, except those of Chinese heritage, earned less than similar white colleagues. While the EIS acknowledges the important relationship between STEM education, employability and the economy, we believe that greater emphasis within the statement of aims should be placed on the importance of STEM education for all children and young people who increasingly, as national and global citizens, require to make judgements about and participate in democratic processes, around such matters as climate change and GMOs. Further, over-emphasis of STEM education in a purely functional or instrumental light risks devaluing the many more intangible, but very real and important benefits, that everyone can gain from a greater appreciation of the breadth and depth of STEM.

Finally, in terms of the strategy aims, the EIS would wish to see reflected in their terms a commitment to the sustainability of the strategy.

The priorities listed would require some adjustment in light of the above comments. In addition, the term 'excellence', although used widely now in reference to the Scottish Government's ambitions for education, is not defined. The EIS does not consider excellence in education to amount simply to high-ranking in international league tables of attainment data.

With regards to the priority to inspire young people and adults in STEM, while it is right to endeavour to do so, this intent must be rooted firmly in the understanding that individuals will be equally, if not more, inspired by other areas of learning. In the interests of personalisation and choice within and relevance of, learning to young people we would caution against over-zealous promotion of STEM among impressionable children and young people, to the detriment of a liberal education.

3. Are these success criteria right?

○ Yes ◉ No

The general focus of the success criteria is agreeable; however, it is our view that they lack specificity.

How will young people's experiences of STEM education be monitored? What additional resources will be made available to ensure that all children experience relevant and engaging STEM education? How will relevance and engagement be judged? The criteria do not specify.

How will the understanding of STEM by all young people and their families be ensured? Again, how will this engagement of all young people and their families be achieved?

While the EIS welcomes the emphasis on improved gender balance across STEM qualifications the criteria do not indicate how much improvement will equal success.

Overall, it is the view of the EIS that the criteria require to be more precise.

4. Do you think the scope of the Strategy is right? Tell us if you think it should exclude something or include anything else. For example, should it include training and development that employers provide for their workforce?

The EIS broadly agrees with the scope of the Strategy and welcomes the acknowledgement of the importance of lifelong learning within it.

With this in mind, the EIS would support the inclusion of training and development provided by employers within the Strategy and would suggest that a further dimension should be extension of the partnership approach that exists between several employers and trade unions in delivering training and professional learning, and between the Scottish Government and the STUC through Scottish Union Learning.

The EIS is also of the view that there requires to be evaluation of the often highly costly training and professional learning that is delivered to teachers and lecturers by external private providers.

5. Give us your views on whether you think the actions already underway across the sectors on STEM fit well with the Strategy and will contribute positively to it.

Our view is that the actions already underway are useful in supporting the Strategy but that there are many of them, with no clear co-ordination. Both of these factors make it difficult for STEM teachers and lecturers to access the full range of initiatives that may be on offer. Lack of co-ordination and coherence makes engagement onerously time-consuming and often prohibitively so.

6. Tell us about activity currently ongoing – either included in this document or not – that you think could be adapted or stopped and why.

Please see answer to Question 5.

7. Do you agree with the principles set out for implementation?

○ Yes ◉ No

The principles place purely functional value on STEM education, and by implication, on education generally, with its worth expressed solely in relation to the economy. Education has great value beyond this for the intellectual development and the well-being of individuals, communities and society.

The second of the principles listed reads as though there is intention to cut funding for STEM initiatives. The EIS is resolutely opposed to cuts to education. Our view is that to raise attainment for all and to make the education system more equitable, more, not less, funding is required. If the ambition to enhance STEM education is genuine, it requires to be properly funded (and not at the expense of other areas of the curriculum).

The final principle listed is vague. It would be helpful to include detail of the performance indicators against which delivery of the Strategy will be compared.

8. What else should Government do to ensure a more coherent approach and maximise impact?

The EIS view is that the document in its current form is aspirational in tone. To maximise the potential for impact, we recommend the inclusion of SMART targets: specific, measurable, attainable, realistic and timely; as well as the identification of the resources necessary to deliver the aims.

9. Overall, do you think this Strategy is clear and action focused? Do you think that the actions that we propose to take nationally will achieve the aims and intended outcomes?

The Strategy is not clear or focused enough, in our view. As outlined in a previous answer, the document in its current form is aspirational in tone. To maximise the potential for impact, we recommend the inclusion of SMART targets: specific, measurable, attainable, realistic and timely; as well as the identification of the resources necessary to deliver the aims.

With regards to the Priority Themes and Associated Actions around Excellence we would make the following points:

With regards to teacher recruitment in STEM subjects, while the EIS acknowledges the need to consider alternative approaches, we would stress that none of these should involve compromise of standards, either through reduction of entry requirements or dilution of the quality of ITE to facilitate fast-tracked entry to the profession.

The EIS welcomes the commitment to developing a programme of career-long professional learning for practitioners based on greater professional collaboration. We are keen to know how this will be resourced to enable teachers and lecturers to engage in such professional learning.

Similarly, we welcome the intention to encourage Masters level learning and would reiterate the view that this should be fully funded by Scottish Government and/ or local authorities, with equality of access to such learning across the profession.

The publication of STEM Benchmarks is likely to be problematic and the Benchmarks open to excessively bureaucratic application in schools unless accompanied by very strong good practice advice and careful, rigorous monitoring of their use thereafter. The EIS is also very concerned about the number of Benchmarks that primary teachers will be required to work with if they are published for all curricular areas, including STEM. They are likely to be unwieldy and therefore demanding of time that would be better spent on the teaching and assessment of children within STEM and other subjects. This will be true albeit to a lesser extent for teachers of Sciences and Technologies in the secondary sector.

Regarding the intention to deliver the Making Maths Count recommendations, the EIS would stress the need for funding to be made available for this on a sustainable basis.

In respect of the Digital Schools Programme, the EIS would caution around additional demands in terms of workload being placed on schools- any testing of innovative approaches would require to be resourced in terms of staffing. We would also reiterate concerns around schools' ICT infrastructure, in terms of availability/ accessibility of hardware and on the effectiveness of software.

Enabling S4, S5 and S6 pupils to undertake high quality STEM work-based pathways is to be welcomed though there are a number of considerations that require to be taken on board. Issues remain around the coherence of the senior phase and the profession requires adequate time to address these. The issue of parity of esteem between academic and vocational pathways remains live and cannot be singularly addressed by schools and colleges; the perceptions of parents, employers and wider society in relation to the status and pay attributable to different occupations are key. Schools require to have staffing allocations that enable meaningful partnerships with employers. Geography and locale play a part in the kinds of partnerships that can be established between schools and employers, making lack of equity in terms of young people's experiences an issue. Rurality is an issue for young people living in several parts of Scotland in terms of their access to education, therefore the provision of free transport would be a necessity to ensure equity of access to work-based pathways across Scotland. While partnership with employers could be useful in enhancing young people's learning experiences, there must be careful vetting of the values, work practices and business behaviour of all employers who may be involved in such partnerships, to ensure that they are ethically sound.

Finally, with regards to supporting the Energy Skills Partnership to increase skills development and knowledge of college lecturers, the EIS would underline the need

for stability and security of employment in order that the benefits of such professional learning can be maximised.

10. Will this Strategy improve equity of outcomes? If not, tell us what else it should include, in particular for women and girls and other groups of people – disabled people, care leavers and minority ethnic communities.

○ Yes ◉ No

In terms of addressing the greatest educational inequality of outcome- that between the most and least affluent children and young people in Scotland- the Strategy does not go far enough.

As with all areas of the curriculum, to address the comparatively lower achievement of relatively poorer children, and indeed to improve the quality of the learning experience and the educational achievement of all, most effectively and decisively, requires significant additional investment in education. Smaller class sizes, capped at a maximum of 20 across the primary and secondary sectors is essential. Currently primary teachers are endeavouring to teach practical science to children in classes of up to 33; secondary teachers responding to the individual needs of up to 33 children in Maths in S1 and S2, and up to 30 in the senior phase. These are not class sizes that will enable every single child or young person to be inspired or enthused by STEM and to achieve their potential.

Class size reduction at all stages and in all subjects, including STEM, would support high quality collaborative learning, for the benefit of all children and young people, and particularly those who face disadvantage caused by deprivation. The increased adoption of such collaborative approaches enabled by smaller classes, would, as early findings from research supported by the Institute of Physics and others seem to indicate, have the potential to make STEM learning more attractive, and less intimidating to girls.

Significantly in its references to equity gaps, the Strategy is silent on additional support for learning. The correlation between poverty and incidence of additional support need, including disability, is highly significant. To enhance the engagement and improve the outcomes of poorer children and young people in STEM, some of who have disabilities, additional investment in additional support needs provision is essential. The EIS is clear that there needs to be reversal of the cuts to ASN provision that there have been in recent years.

Investment in equipment and practical resources are also key to this agenda: ensuring that all schools have adequate funding for the specialist equipment, materials and resources that are crucial to delivering high quality practical learning and teaching across the range of STEM subjects. For example, secondary science subjects have seen cuts of 25%-35% to their budgets for equipment and resources in recent years, making the purchase of 'big ticket' items of equipment,

and even the replacement of old broken equipment difficult if not impossible. In addition, departments are struggling to buy consumables such as chemicals, batteries and bulbs, as budgets have to be spent on basics such as jotters, pencils and printing costs. Such shortage of funds has a huge impact on the amount of pupil practical activity that can be done with teachers having to resort to demonstration, the use of video and simulation which they are clear does not adequately meet the needs of learners.

A particularly damaging cut has been to the level of specialist technical support available to support practical work in STEM. Schools have seen drastic reductions in the number of technicians working to support STEM, and the hours for which they are employed: in some cases, technicians are having to work in several schools; in others technicians have been transferred to sessional contracts, meaning that maintenance and development work that would have taken place over school holidays cannot now be done. It would be instructive for the Scottish Government to undertake a comparison between the level of technical support that private schools provide to support STEM education, and that available to teachers and students in the state sector.

11. What could schools, colleges, universities, community learning and development, the voluntary sector, science engagement providers and museums do to support the areas for action?

With additional resources as outlined in previous answers, schools would be well placed to support the various areas for action, without detriment to other areas of the curriculum or to learners whose interests and talents lie in curricular areas other than STEM- in Social Subjects and the Arts, for example.

Colleges, in addition to improving the conditions of employment of their lecturer staff, should examine how significant cuts to the number of part-time courses being offered has impacted on access to STEM study for female and disabled learners in particular.

12. What could professional organisations and bodies and third sector organisations do to support the areas for action? This includes, in particular, the General Teaching Council for Scotland, the CLD Standards Council, the teaching unions and representatives and the Learned Societies.

The EIS will continue to engage with Scottish Government and local authorities around the resourcing of education, including STEM; with Education Scotland and SQA on relevant learning and teaching resources and qualifications respectively; and with GTCS and initial teacher education institutions around training for and entry to the profession, of STEM graduates.

13. What more could science centres and festivals do to complement and enhance STEM formal education, to inspire scientists of the future, and to ensure their activities support those of the Scottish Government and its agencies?

Cost of access to the science centres is prohibitive for many families. Entry fees for the Glasgow Science Centre are listed below by way of example. Science centres, if they are to be fully inclusive, must consider how cost barriers can be removed for children, young people and adults suffering deprivation.

Science Mall*

Adult

£11.00

Science Mall*

Child / Concession

£9.00

Planetarium Add On

Adult / Child / Concession

£3.00

IMAX Documentary Add On

Adult / Child / Concession

£2.50

Glasgow Tower Add On*

Adult/Child/Concession

£3.50

Glasgow Tower only*

Adult/Child/Concession

£6.50

Planetarium Only*

Adult/Concession

Applies to the last show of the day only.

Suitable for visitors aged 7+ only.

£5.50

Science Passport

12 months free entry to Science Mall

Adult

£27.00

Science Passport

12 months free entry to Science Mall

Child / Concession

£21.00

Science festivals are commonly scheduled to take place during school holidays. Many parents within poorer families, in addition to facing cost barriers, are in insecure, low paid employment in which holiday entitlements often fall short of school holiday allocations.

Greater care should be taken, therefore, to align the timings of festivals with school terms, avoiding exam diets, in order to maximise access for all children and young people in Scotland.

Science centres and science festivals must continue to work to ensure that they provide a service to all sectors of society, and a key target of their work must be greater engagement with those living in rural areas or from socio-economically disadvantaged groups.

14. Should this Strategy identify more actions for particular sectors, for example in relation to workplace and work-based training and development? Please make suggestions on what these actions could be.

In addition to the suggestions made with regards to further action by employers to provide work-place training and development, in the interests of the Fair Work agenda, the EIS believes that more could be done by STEM employers to recruit workers from under-represented groups - women, minority ethnic and disabled people, and those from working class backgrounds - by providing training in unconscious bias to those involved in recruitment processes. Careful equality monitoring should be in place with regards to recruitment processes. Employers could work together with trade unions on this.

The same is true for equality monitoring and analysis of data on access to training, and on retention and career progression. Data should be used to inform policy and practice - for example around flexible working and reasonable adjustments for women and disabled workers respectively, and on accessibility and suitability to the needs of all of training offered. Again, trade union representatives, particularly Equality Reps, could assist in this. This is particularly crucial if the STEM sector is to prevent the continuing loss of female talent as a consequence of workplace cultures, pay gaps and practices that are unfavourable to women.

Employers could also establish, as may progressive employers do, mentoring programmes and bespoke training for under-represented groups, in the interests of developing and maximising the talents of all.

Finally, employers could demonstrate clear commitment to equality and diversity by providing training for all employees in this area, with regular refreshes, and public display of materials that reinforce the organisation's commitment to a fully inclusive ethos, and non-discriminatory policies and practice.

15. Tell us what you think about this Improvement Framework. How can we best ensure uptake of this Framework in early years learning settings, schools and clusters?

Excessive teacher workload and widespread teacher and supply teacher shortages must be uniformly addressed in order for schools and clusters to push forward with the terms of the Framework.

The EIS would not, for example, support the appointment of a named person for STEM within an establishment without the individual being given additional time in which to carry out the role. Remuneration for promoted staff may also be an issue. Scottish teachers are currently among the most class-contacted in the world, meaning that they have less time to spend on innovation and collaboration with colleagues in areas such as STEM.

While the EIS welcomes the emphasis on professional learning, as previously stated, with inadequate numbers of teachers and supply teachers, it is difficult to see how teachers will be afforded time out of the classroom to devote to this.

In terms of enhancing knowledge of careers in STEM, cuts to the careers service will make this challenging.

A further significant challenge to the uptake of this Framework is, as previously mentioned, the huge reduction in the number of technician support staff which has had a detrimental impact thus far on teachers' ability to organise practical learning activities in Science and Technology. With cuts to this service of around 40% in recent years, much equipment remains in a state of disrepair and teachers can no longer rely on technicians to the same extent to prepare chemicals and electrical equipment, for example, for practical experiments. Not only does this curb innovation in learning and teaching but makes the role of school technician an unattractive career option.

The EIS, while acknowledging the importance of STEM education and its value to the economy, is clear on the need to be mindful that the primary curriculum requires to be de-cluttered- there are currently too many initiatives underway and streamlining is required. In streamlining and giving emphasis to STEM skills, care must be taken that STEM does not dominate the curriculum in such a way as to prevent skills exploration and acquisition in other important curricular areas. Equal value must be attributed to the interests and skills of all children in all areas.

Also with regards to equity, diversity and equality, there should be explicit reference to the need to ensure that teaching materials at all stages reflect the role that women and minority ethnic people have played in the world of science and technology, which has been largely under-played within or omitted from

lessons, text books and other resources. Teaching materials therefore require to be equality-audited and updated where necessary in this regard if the subjects are to be genuinely inclusive in their reach.

16. Tell us what you think of our proposal for developing a model of collaboration between schools, colleges, universities and employers. How should we now take this forward?

The EIS favours collaboration among education professionals and has repeatedly advocated for time to be made available for this within teachers' and lecturers' working time. Models of collaboration such as the LUMA centres in Finland are made possible by having teachers employed in such numbers that cover is available and sufficient time is created for collaboration within the working week, in addition to the time required for delivering lessons and the associated preparation and correction.

In terms of collaboration with employers, please see comments in response to Question 9.

17. Tell us what you think of our proposals for a Scottish STEM ambassador network. How should we now take that forward?

The EIS would question why another additional ambassador network is being established.

We would also emphasise the same need for ethics monitoring of members of the ambassador network as with employer partnerships.

Again, schools and teachers will require time to access and engage meaningfully with the network.

18. What other groups, organisations or people need to be involved in delivery of this strategy?

Employers in the terms previously indicated.

Science funding bodies such as the Science and Technologies Facilities Council.

19. Tell us about what you are doing in your organisation, establishment or community that supports the aims and priorities of this Strategy.

The EIS as an affiliate of the STUC works with other trade unions to promote workplace equality and diversity.

As a professional association, we have undertaken several pieces of work on gender inequality and gender stereotyping; and have campaigned for some time on the impact of poverty on education. In all of this work, we have engaged with partner organisations and our own members.

20. What could employers do to attract and retain more diverse STEM talent?

Suggestions for this have been included in the answers above. To develop robust pro-equality recruitment and retention practices, employers should seek the expertise of trade unions in this area and fully involve representatives in shaping all relevant policy and practice.