

Education Scotland, Science Conversation Days Summary

Following the publication of its 3-18 Curriculum Impact Report for Sciences in September 2012, Education Scotland organised a series of conversations to engage stakeholders in discussions on the findings of the report and to collectively identify priorities for action to secure improvements in science education nationally.

This document highlights the key themes to emerge and details the views and suggestions of the delegates in attendance.

Priority areas for action

Primary science

- There is a lack of specialist knowledge in primary schools. There is a need to increase access to and quantity of science learning pre-secondary by building confidence of primary practitioners.
- Science should be made explicit in primary schools – not just taught through interdisciplinary learning.
- Science champions required in primary schools.
- Initial Teacher Education has to recognise importance of STEM specialism - primary schools need access to teacher specialism
- Improve practitioner knowledge and expectations in terms of wider skills development.
- Remove layers of bureaucracy. Decide what can go, to create space we need.
- Lack of confidence in science knowledge and expertise can affect learning and teaching in the primary sector.
- Primary practitioners are fully aware of the importance of bringing the real world into the classroom to motivate and engage learners - access to relevant, high quality Professional Learning and time to commit to it important
- SSERC - more info about available courses – central info point?
- Qualified teachers in the STEM subjects would be advantageous in the primary sector
- Practitioners in primary schools are mostly not science graduates – do they need a science background to be able to teach science effectively?
- Increased opportunities for science related career-long professional development, including through initial teacher education, should be made available to develop enthusiastic, confident and skilled practitioners who employ effective teaching strategies.
- Specialist support for teachers may be of benefit – potentially in the form of a visiting specialist. Children age 9 + would be appropriate target audience.

Cluster approach

- Local cluster science improvement plans should be developed – early years/ primary / secondary school links, including links with further and higher education institutions, should be further developed to allow staff access to specialist equipment and expertise and to facilitate dialogue between practitioners
- Early years, primary and secondary colleagues should work as a team and there should be greater use of cross – sector links e.g. primary pupils should be invited to the secondary science club.
- Primary and primary/secondary transition should be seen as a priority for cluster working- avoid the fresh start approach in secondary schools
- There should be planned progression through increased dialogue within and between centres and clear maps of learning and contexts.
- STEM needs to be on all school/cluster improvement plans – will see benefits for learners once they reach secondary school in terms of seamless transition/progression Important to ensure smooth transitions, not just from primary to secondary, but also beyond school education into HE/FE or work.
- Stronger cluster work would help address lack of consistency in primary experiences across a local authority – benefits for secondary in terms of ensuring good pupil progression
- More time is required for secondary teachers teaching S1 secondary classes to work with primary counterparts
- Encourage schools to use exemplification, and build on what is already being done
- Cluster working will provide opportunities to support the professional development of practitioners. Primary and secondary colleagues learn from each other and build an understanding of learning and expectations for learners in each sector
- Provide resources and time to establish and continue effective clusters. Issue of teacher cover to be addressed.
- Developing good numeracy and literacy skills in primary helped access the sciences curriculum. This did not appear to be continuing at secondary, why?

Partnerships

Need to ensure STEM is added to local authority plans as a priority, with weight added by national government:

- Competing demands of secondary schools is a particular issue – work on new national qualifications is a priority
- Schools have been getting to grips with some of the key aspects of CfE, including the ‘responsibility of all’ areas
- Partnerships tend to depend on postcode lottery – need coherent approach and consistency across the country.
- Partners should move towards provision of long-term support – in some areas they are already queuing up to be involved. They also need to move from promoting their own interests to promoting a common purpose.

- Activity with partners still tends to be an add-on – we need to embed it within learning.
- The business case is compelling but is not being communicated in terms of the impact on children.
- We need to celebrate success stories from the STEM Ambassador network for instance.
- Teachers are a vital source of career information but their knowledge about jobs in science is inconsistent – we need to address this.
- It is important that everyone has a sense of the existing landscape – the new SSAC Coordinator can help with this task. This will bring coherence and a sense of common purpose to our activities.
- Education Scotland has a role to help make connections between schools, partners and different organisations and needs to consider the validation or endorsement of providers.
- We need to consider the role of specialists to support STEM activity within clusters:
 - Connection with STEM Ambassadors
 - Work with the science centres and HE
 - Ensuring partnerships are meaningful and not ‘one-off’ – they should dovetail with on-going learning.
- The example of the Department of Geosciences at Edinburgh University was cited as a model for partnership working – final year undergraduate students have been working with a school cluster. The schools have gained but also the university students have gained too in terms of employability skills, communication skills etc. This work provides them with 20 credits towards their degree qualification.
- Organisation must provide support in the classroom and visit the school (not the other way)
- Partnerships should be innovative, curriculum led, embedded in the curriculum
- Personnel involved - enthusiastic individuals with a willingness to commit extra time to establish short/long term working relationship
- Investment and funding through the partnership should provide opportunities for all

Aspects for development in partnership working:

- not enough organisations/partnerships to support early years
- more visiting scientists lecturing at a high level – aspirations needed to be raised
- speakers need to be able to pitch talk at right level for young people
- mixture of input needed for different levels of interest required
- better and more accessible links with industry, including STEM ambassadors, are required – it is essential to secure the involvement of people with real experience of STEM subjects. A coherent approach, and mapping process, is required to pull together different agencies and employers to ensure support structures are in place and to make young people aware of job opportunities.

Equity in education – science for all

- It was recognised that there had been many initiatives and significant funding provided over the last few decades to make education more equitable but little progress had been made. We need to look at things differently – not just repeat what

we have been doing. We need to close the attainment gap and ensure those from the most deprived backgrounds are not disadvantaged further by their educational experience.

- Science education is about promoting scientific literacy for all in addition to preparing learners for STEM careers. We should seek to inspire all learners - not just those who intend to pursue science at university level.
- We need to equip parents with the language of learning and help them appreciate the importance of STEM e.g. Bishopbriggs Academy has run open evenings for parents to engage them in the school science programme.
- The broad general education (especially early years and primary) should be a priority since this is where all learners have the biggest exposure to science.
- We should be offering more than one career pathway – not just school, further study then work. Many STEM careers are at Technician 3 Level – degrees are not the only way. We need to promote awareness of this.
- Science should be seen as a skill for life. An example of this is the evidence-based decision making developed within sciences which has wider application.
- Initial teacher education (ITE) establishments have introduced concurrent degrees – more primary teachers will have the opportunity to study STEM subjects at undergraduate level but there are timetabling issues to be addressed to enable student teachers to access courses in other faculties.
- Good science coordinators in local authorities play an essential role in brokering effective links between schools and between schools and partners.
- To attract greater number of learners into STEM then need to address gender bias within subjects such as prevalence of boys in Physics:
 - Need to consider influence of female teachers, and positive role models for learners choosing science (from industry and HE)
 - Misunderstanding the subject, and maths connection may put some learners off.

Support

Science - Local Authority priority

- Raise the awareness of education leaders, directors of education, head teachers and councillors to the importance of science is necessary - recognise that science and STEM is a priority.
- Local authorities should lead and coordinate science in all sectors. They should be providing early years and primary teachers with high quality, sustained science CPD opportunities
- Every primary school should have a science coordinator/nominated teacher with responsibility for science.
- Education Scotland should promote and support professional learning communities within authorities.

- If science is a national priority, funding should reflect this to ensure all authorities have a science QIO to increase teacher confidence, help moderation, sharing and development of practice etc.
- East Dunbartonshire had offered a presentation on the 3-18 Sciences report to its schools, which had then prompted primary schools to integrate sciences into their planning.
- Leadership for sciences within schools at every level, including learners, should be developed to ensure support is in place and to facilitate good communication
- Authorities should provide financial support to assist practitioners in accessing resources to facilitate and support their teaching.

National improvements in science education

Resources

Raise awareness of support and resources available from external partners to support and enhance science learning and teaching in schools and how to access these. Create a cohesive bank of locally and nationally available resources including easy-share resources, equipment, ideas and teaching materials

Practitioners need to know about the resources out there. Funding to local authorities and partner agencies should be prioritised to ensure all centres are well equipped. Effective dissemination of available resources is required including online resources, outdoor spaces for learning etc.

Rural outreach

Support outreach by science education providers such as science centres, Edinburgh Zoo etc. to remote and rural communities to deliver and facilitate programmes. Financial support would be required for this

Assessment

A continuum of assessing and moderation in relation to significant aspects of learning

Skills

Progression of skills for life, and thinking skills, for 3-18 in context of the sciences e.g. investigation, fair tests and no gaps in first level E/Os. Look at progressive methods to build up skills – models from various schools/authorities to view and discuss. Need to explore more opportunities to embed higher order thinking skills and ways to evaluate the pupil/staff recognition of their learning in the broadest sense.

Exemplification

A clear, easily-searchable database of good practice is required which is regularly updated. Include pupil-voice section.

Pupil voice and citizenship

Discover “pupil voice” as a meaningful constructive tool in improving learning. Develop Informed participation - recognising right to learn in United Nations Convention on the Rights of the Child. Valuing wider learning also. Take on board message from young people about problems. Focus on citizenship.

Time/Finance

Scottish Government should support this financially to take science forward. Financial input should also be sought from sponsorship from public/private sectors to invest in the future of STEM.

Public engagement

Need outreach programmes involving all stakeholders in activities that are science based e.g. parents invited in to take part with their pupils.

Sharing

Need a good way to share expertise, (written and physical) resources and course materials across Scotland with feedback inbuilt into the system.

CLPL in science

To be targeted at *all* staff not single practitioners.

Recognition of lifelong learning

More emphasis on this for all practitioners:

- Need to provide support from FE, HE and industry
- There should be a clear opportunity for teachers to extend learning to master’s-level
- Drawing together of HE and other organisations to facilitate a move towards accreditation.

There is often an **artificial connection between formal and informal science education** – and a recognition that the structured/rigid way which science is taught in secondary schools needs to change to reflect the realities of the wider world.

Important to influence the work of the **National Implementation Board** to ensure needs of education system in relation to sciences are met

Education Scotland

- Simplify the quantity of advice on websites and make new glow user friendly
- Science in the news blog page – items in news, press releases are good to use in lessons but access to a ‘schools version’ on Education Scotland website would be a huge benefit. This would need good links between Education Scotland and industry.
- Consider developing a resource bank with download log and feedback.
- Access to web -based learning resources through Education Scotland courses. Need to support teachers in a coordinated way to develop skills, resources, links, assessment methods

What does great learning in the sciences look like?

Science education is important for every child and not just for those who may be headed toward a scientific or technical career.

Great learning in the sciences encourages young people to make sense of the world around them, to be scientifically literate. It develops skills enabling them to analyse, evaluate, think critically, justify conclusions and be creative and innovative; skills required to thrive and succeed in an increasingly globalised and technological society.

Factors contributing to great learning in the sciences:

- relevant and purposeful (real life) teaching through engaging activities, which occur in and out of the classroom environment
- learning environment has motivated and enthusiastic teachers and pupils
- lessons have variety, depth, challenge and are interactive, delivered by inspirational teachers with a passion and enthusiasm for the subject and who convey a love of learning
- consistent and firm discipline
- learners are taught the skills they need through a variety of methodologies e.g. active, visual, audio and concepts are revisited in different ways
- progression is evident
- subjects are interlinked and connected
- great learning is different in different schools and classes - good teachers are still learning.
- Learning and teaching in sciences needs to be dynamic and up to date so that learners understand the relevance and applications of their learning. More outdoor learning and interdisciplinary/multidisciplinary learning (IDL) should be encouraged to put science into context. There should be consistency in terms of the provision of high quality learning and teaching in sciences.
- Need to involve learners in prioritising improvements
- We need to move away from tick box approach in identifying outcomes.

How do we get science education right for every child and young person?

- Good communication between primary and secondary
- Establish where the “starting point” for every child is and identify children who need to extend their knowledge
- Ensure learners feel safe enough to ask for help/guidance
- Quality provision must be evident all the time
- Teaching should be delivered in different order/style depending on the needs of the learner.
- Pupil voice should be strengthened at departmental and whole school level – the experiences of learners, and their involvement in decision-making, can be used to drive improvement. There is a need to develop a culture of talking to learners and including them in evaluation of learning. Facilitation of informal feedback should be encouraged and programmes of learning should be explained to learners.

Attainment

- Initiatives have been undertaken to address the gap in attainment - more are required to ensure those from the most deprived backgrounds are not disadvantaged further by their educational experience
- Importance of support from home should be encouraged through good communication between parents and staff

Learners' - key priorities

- The relationship between learner and teacher and good communication is the key to successful learning in the sciences– must feel confident about asking for help
- Active learning in the sciences should be a priority
- Practical activities important - help engage learners and develop HOTS
- Homework should be relevant to the learning at the time and coordinated better between departments to avoid overloading learners
- Learning through real life contexts is extremely important
- Practitioners–address the variety of learning styles/offer a variety of teaching experiences to engage and motivate pupils.