

Education in Science

Number 289 ■ September 2022

Technician
special



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for **Science Education**

Promoting Excellence in Science Teaching and Learning

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Association of the British
Pharmaceutical Industry

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careers@abpi.org.uk

Take a look at the ABPI schools website

The ABPI website for schools and colleges is highly valued by teachers. Up to 250,000 people use the site each month.

It provides teachers and students with high quality, free, curriculum related, interactive resources containing animations and diagrams which can be downloaded. All our resources link science topics covered in school to the world outside the treatment of disease, and other areas of topical interest.

The site has been redesigned while keeping all your favourite features:

- Free to use
- No login required
- No adverts
- High quality animations
- Interactive questions
- Download library

For a list of topics covered or to explore the topics available for each age group visit the website www.abpischools.org.uk



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Editorial

Welcome to September *EiS*. I hope you're having a good start to the new school year.

As always, this issue is packed with news and articles, including a special feature for technicians, articles from the Ogden Trust and on maths in science, a thank to you John Barker for his incredibly generous legacy to ASE, and details of January's unmissable Annual Conference (including both face-to-face and hybrid options). Plus, a fantastic opportunity to become one of the editors for our new format *SSR*.

As this is the last Editorial before I move to my new role at the British Science Association, I hope you will excuse a few extra thank yous. There is no doubt that the last three years have been tough for both education and charities more broadly, but ASE has risen to the challenge across all areas of activity, including our online conferences and events, new membership categories, digital-first model for our journals, new online bookshop, and a fantastic breadth of projects supporting all parts of our community. We have continued to advocate on issues facing primary, secondary and post-16, ranging from practical science to assessment, continuing professional development, diversity and inclusion, environmental education and more. It has been an enormous privilege to lead the ASE through this period. I'm incredibly proud of what we have achieved and wanted to say a huge thank you to everyone who has helped to make this happen, including our Trustees, Presidents, committees, speakers, authors, everyone involved with our projects, our funders, exhibitors and sponsors and, most of all, the ASE staff team for their expertise, inspiration and determination.

I also wanted to thank you, our members, for your dedication to the profession, particularly through the pandemic, balancing personal and professional challenges to continue to provide excellent science education, against the odds. I hope you have had the opportunity to benefit from the support and professional learning opportunities available through ASE and, if you haven't already, I'd encourage you to get involved – you won't regret it!

As we hopefully emerge from this unprecedented period, the Association can look to the future with confidence as we hand over the baton to ASE's new CEO, Lynn Ladbrook. Lynn brings a wealth of chief executive experience to the role, having led charities including Breast Cancer UK and the Primary Care Respiratory Society, as well as working in senior roles at the World Wildlife Fund and National Trust.

I will very much miss ASE (although I will of course continue to be a member!), but look forward to working with many of you again through my new role and to seeing ASE continue to go from strength to strength in the coming years. Thank you again for all your help and support.



Hannah Russell
Chief Executive

Contents

Page

- 4. News
- 8: Chair of ASE 2022/23
- 9. Improving subject knowledge and confidence in teaching physics
- 10. SEND: the importance of consistency
- 11. Early Career Teaching: What's on at AC23 for trainee and ECT teachers?
- 12. Feature: Technicians Special
 - Cut out and Keep
 - Show my Prep Room
 - Open Evenings
 - News from the ASE Technicians' Committee
 - Technicians' Workshop: Learning from failure
- 19. The Great Bug Hunt 2022
- 20. Annual Conference 2023
- 22. Ideas for delivering practical CPD
- 24. More from AC22
- 25. Resources
- 26. Bookshelf
- 28. Improving learning outcomes for science students by focusing on developing their mathematics skills
- 30. A Limit Less life with physics

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ASE RISE (Retention Initiative for Science Educators):

Keeping your science teachers well, satisfied and working with you

Keeping good science teachers in teaching is a challenge for Heads of Science and school leaders.

You may have seen the ASE Science Teacher SOS document, which supports science teachers who are thinking of leaving the profession. ASE has now developed a proactive approach for Heads of Science to understand the wellbeing needs, job satisfaction and career intentions of their science team, known as ASE RISE.

It's a short online survey that is carried out by your science staff. The anonymous data are provided to the Head of Science along with a comparison to the pooled data from all participating schools. With video guides and a plethora of ASE RISE hub resources, Heads of Science can make bespoke plans for the year to support the needs of their team.

The anonymised data from all participating schools are collated to form a 'state of the nation' of science teachers' wellbeing, job satisfaction and career intentions, which ASE uses to inform research, support science teacher retention and influence policymakers. There are three easy steps to follow:

1. Sign up now to express your interest (www.ase.org.uk/rise-retention-initiative-science-education-programme).
2. You will be contacted leading up to the launch of the survey (a two-week window, 10th-21st October), when we encourage you to maximise staff engagement.
3. After half-term, receive your department data and use the ASE RISE Hub videos and resources

to analyse your department's needs and put together a bespoke action plan.

You need to have ASE Science Department membership to take part for free, or contact ASE (info@ase.org.uk) to find out non-member rates for participation.

Let's work together to keep our best science teachers well, happy and working with you!

Useful links:

<https://www.ase.org.uk/sos>

<https://www.ase.org.uk/news/final-sos-science-teacher-retention-report-now-available-follow-project-launches>

<https://www.ase.org.uk/rise-retention-initiative-science-education-programme>

<https://www.ase.org.uk/institutional-membership>

John Barker

On Sunday 8th May 2022, around fifty people gathered in the Mappin Pavilion at London Zoo to celebrate the life of John Barker. John qualified as a biology teacher working in South London schools and then became biology education tutor at Chelsea College's Centre for Science Education (later to become the Centre for Science and Mathematics Education), where he contributed, among other activities, to the development of the Nuffield Biology course.

When Chelsea College merged with King's College and Queen Elizabeth College, John moved to the newly-established Waterloo site, running the PGCE Biology course, and also taking on the role of PGCE Director. John fostered a deep admiration and interest in, and for, practical biology, which was obvious when you visited his teaching lab with its myriad of plants and assorted animals. John was also a keen supporter of ASE and a regular attendee at the Annual Conference over several decades. He was in his element meeting and interacting with enthusiastic science

teachers, and Conference provided an ideal event for this to happen each year.

John Barker generously left a large donation in his Will to ASE and, in response, ASE is offering support for three trainee teachers to attend ASEConf2023. For more details, please see page 11 of this issue of *EiS*.



Farewell and thank you, Hannah!

After three years' leadership of ASE, Hannah Russell is moving on to be CEO at the British Science Association. We wish her well and are looking forward to closer links between our two organisations in the future. Meanwhile, this is an opportunity to highlight what she has achieved in her time at ASE, and to say thank you.

Hannah joined us in September 2019 from the Biochemical Society where she had been the Director of Society Programmes. Despite having not held a CEO position previously, she took advice from Shaun Reason and from Trustees in making her decisions and learned quickly to become a very effective leader. Trustees had a strong rapport with her, and great confidence in the way that she ran the Association.

Then Covid struck, which challenged even experienced charity CEOs, but Hannah, working with Trustees, made some difficult and strong decisions that meant that ASE was in a good position to support members and the profession through a difficult time. We quickly adapted to new ways of working, whilst maintaining an effective organisation.

Throughout the pandemic, ASE supported learning and practitioners in schools by providing professional development, access to quality-assured resources and online spaces for continued mutual support. The online conferences were ground-breaking and proved a 'life saver' for so many people. Hannah did not just enable ASE to survive this period, but also to grow as a key support mechanism for science education, as teachers struggled to provide education for their students. Despite the significant pressure from the pandemic on all charities and on everyone working in education, in many ways the



Hannah and Jane Turner outside Westminster Abbey in March 2022

Association has gone from strength to strength, with increased visibility and profile among our community and other key stakeholders and new areas of activity undertaken to support science educators.

A key piece of work from Hannah was the creation of our current strategic plan, drawn up in consultation with the whole cross-section of ASE. Its clarity of purpose and sense of direction has informed much that has been achieved under Hannah's leadership.

A significant legacy of her tenure is the focus on increasing diversity and inclusion, both within ASE and the membership, and in its activities. As part of this, Hannah made a submission to the Science Council 2021 benchmarking exercise, resulting in a Benchmarking Report on diversity and inclusion, which is proving a valuable platform on which to build. ASE has become the lead delivery partner for the Department for Education's *Inclusion in Schools* programme and has also introduced a new practical science support programme for schools in disadvantaged circumstances.

Hannah has had a massive impact in terms of securing new projects, bringing increased visibility for ASE and productive partnerships with organisations across the sector, as well as funding. The Mary Anning project for the Templeton Foundation was a particular highlight. Work to develop ASE engagement in India and China is ongoing.

At policy level, Hannah has had regular meetings with the DfE curriculum team, advocating for improved teacher assessment in primary science, and has been a significant contributor to the STEM Learning Science Working Group, working with other leading organisations to develop a vision for subject-specific support for schools and colleges.

Together with the Chair of ASE 2021/22, Jane Turner, Hannah represented ASE at the memorial service for our Royal Patron, HRH the Duke of Edinburgh, in Westminster Abbey.

Jane says: *'It has been an absolute privilege to work with Hannah during my year as Chair of the Association. Her good humour never fails, she works unbelievably hard, and is insightful and principled. She cares so much for every single member of the Association and of the staff, respecting the commitment, expertise and experience within ASE and leading us all with great modesty, flair and strength. We have worked on so many projects together over the last two years, with far too many late-night e-mails and conversations and yet I know that I have only glimpsed a fraction of what she has done as CEO. She will be very much missed, and I wish her every success in her new role at the British Science Association, where I know she will continue to be the very best of friends to ASE.'*

The latest Green Tick evaluation summary

SEEN (Secondary Education around Early Neurodevelopment) Programme

<https://www.kindredsquared.org.uk/seen-programme/>

This resource has been developed by the SEEN research project at the University of Oxford and aims to emphasise the importance of early brain development within the curriculum. The rationale for this programme is that the first 1001 days (pregnancy and the first two years of a child's life) is a critically important period for development, which significantly influences a child's long-term health, wellbeing, learning and earnings potential. Where better to educate society members of the future than at school?

The resource comprises three fully-resourced lessons, which cover

brain development in the early years and throughout life, and the role of caregivers in brain development. Each lesson has a well-structured PowerPoint presentation and includes worksheets and links to online activities. There is sufficient information on the slides and task sheets to allow teachers to act as facilitators without requiring significant levels of prior knowledge of the topics. At the same time, there is not an overload of information and content is chunked in a way that will support learning.

The Teacher Pack provides detailed support for teachers and links to the relevant specified curricula, including Key Stage 3 (age 11-14) Science (National Curriculum for England) and Social and Emotional Learning (covering aspects of PSHE, Character and Relationships education).

Although this resource is structured as a package of three lessons, there are other ways in which the lessons could be used. For example, each lesson would make an excellent resource for delivering aspects of the developmental content of GCSE (14-16) and A-level (Post-16) psychology courses.

In conclusion, the SEEN resources are an excellent resource for complementing the science curriculum, by providing a fully comprehensive set of activities that allow students to explore a topic that is not only fascinating, but also has relevance to us as individuals and as a society.



LabAid foundation

Despite all the disruption caused by the pandemic, the LabAid Foundation has been able to continue the work started in 1991 by the late Alan Welch, MBE. In effect, LabAid recycles donations of used scientific equipment, mainly from schools in the UK, and sorts, checks and packages it for sending to schools and similar establishments in developing countries.

As for many charities, the pandemic has caused some problems. LabAid relies on volunteers and we need more! We would especially value someone who could check and clean donated microscopes (at home – training could be given).

Despite the difficulties, from July 2021 to June 2022 13 schools were helped, with a total of 123 boxes of science equipment sent out, only



Teachers from the Hooke Court-supported school in the Bandawe district of Malawi unpacking the boxes from LabAid

LabAid

marginally fewer than last year. In all, establishments in 8 countries were supported in this way: Cameroon, Ghana, Nigeria, Sierra Leone, South Africa, South Sudan, Uganda and Zimbabwe.

At present, there are about a dozen schools in the pipeline, which would take about 9-12 months to fulfil. We do have sufficient stocks to meet these requests (and more), but the need for more volunteers is slowing the process. Can you help? If so, please contact labaidfoundation@labaid.org or visit www.labaid.org

Dr. Peter Borrows, Chair of the Trustees of the LabAid Foundation.

Exciting opportunity: new Editors wanted for SSR in Practice and SSR in Depth!

With the change in format to SSR now launched, ASE is seeking two Editors, to work in a collaborative way, to further develop the two parts of the journal.

Commissioning Editor (SSR in Practice and SSR in Depth)

Role and responsibilities:

- To compile contents list for future issues, liaising with relevant ASE groups, the Editorial Board/ Advisory Group, and using own networks, to identify suitable topics, authors and contributions for both parts of the journal, as well as monitoring contributions from the ASE groups.
- To brief authors of non-committee-generated articles to ensure that they fit the ethos of the journal.
- In consultation with Managing Editor, to plan ahead ensuring balance within an issue and across the year, to support classroom practice for *SSR in Practice* and how *SSR in Depth* supports this.
- To liaise with Managing Editor to ensure a consistent and high

quality pipeline of good articles for *SSR in Depth*, and to identify potential crossover of material; also to monitor the flow of unsolicited articles and how these relate to any commissioned pieces

- To liaise with ASE Business Manager regarding in-text adverts and science/industry career-sponsored spread per issue for *SSR in Practice*.

Managing Editor (SSR in Practice and SSR in Depth)

Role and responsibilities:

- To discuss and agree, with Commissioning Editor, future issue plans and crossover between the two journals.
- To consider all articles as they come in (either commissioned or

unsolicited, for both journals) and allocate reviewers.

- To receive reviews, collate and (if necessary) adapt them in a supportive manner and send to authors.
- To receive revised articles, liaise with authors concerning suitability, length, and adherence to reviewers' comments.
- To do final edit before sending to production team.
- To work with HQ and SSR production team to take articles through production process.

Both roles will be fully supported in an administrative way by HQ staff members, and both are remunerated positions. We are looking for both Editors to commence work during the autumn term 2022, to work alongside the current Editors in preparing for the spring 2023 issues of SSR in Practice and SSR in Depth.

Further details available upon request from Pauline O'Connor (paulineoconnor@ase.org.uk). Closing date for applications: **7th October 2022**.

Your support is urgently needed...

For two years and despite a plea for co-option, no members have come forward to serve on the Quality & Audit (Q&A) Committee. It now needs up to two new members. Can you help?

Let's cover what Q&A is. It's an integral part of ASE's Royal Charter. Its purpose is to monitor the Trustee Body's management of the Association's resources and to report accordingly to

the members in a General Meeting. It is the safeguard of members' interests.

How often does it meet? It meets online two to three times a year. It sends an observer to the Trustee Body meetings. The CEO attends the Q&A meetings and brings reports to them. We need two members to join the Committee to help to ensure that ASE is an effective organisation operating

in the best interests of its members and in accordance with its charitable objectives.

Do consider volunteering! If you would like to find out more, please contact Alan Rhodes on alanrhodesase@gmail.com or download a nomination form from the ASE website: <https://www.ase.org.uk/content/committees>. Please return forms to Headquarters by **31st October 2022**: elections@ase.org.uk

Thank you.
Alan Rhodes

Chair of ASE 2022/23 – Helen Harden



As I start my year as Chair of the Association, I want to ask you one question. What do you get out of belonging to ASE?

Initially, belonging to ASE may mean accessing quality CPD through reading journals, watching webinars or attending face-to-face TeachMeets and conferences.

For those who get involved, ASE can mean being part of a nationwide network of like-minded science education colleagues and friends.

A highlight of my year as Chair-elect was the national committees' day in June, when so many of our committee members were finally reunited. It was a highly productive, and almost emotional, day. Without our active members, ASE simply would not be able to support the science education community. We are grateful to every single member who gives up their time, in any way, to support the Association.

This year marks my 27th year as a member of the Association, but I only became actively involved whilst on maternity leave after the birth of my

eldest son. Whilst a busy teacher in the classroom I felt I had no time or capacity for anything extra at all. Every minute seemed filled with lesson planning, marking and ordering equipment. I was also teaching at a school that was in difficulties and my deepest professional regret is not engaging with ASE sooner.

On a personal note, I am truly indebted to my Chair Trio colleagues 2021-22: Chair, Jane Turner, and Immediate-past Chair, Simon Quinell, from whom I have learned so much. We would like to thank ASE's outgoing CEO, Hannah Russell, who has steered ASE through some very choppy waters. I am so excited to welcome our new Co-Chair-elects, Leigh Hoath and Alex Sinclair, to the 2022-23 Chair Trio. We have an exciting year ahead, as we bid a fond farewell to Hannah and welcome our new CEO, Lynn Ladbrook. The Chair Trio are looking forward to working with Lynn as she steers ASE into new waters.

As Chair this year, a key priority for me will be to encourage many more members to engage actively with ASE.

The more members who contribute, the more ASE can do to support members.

So, my challenge to you is to take part in some way, however small: tweet about a positive experience of being part of ASE or tell a colleague, join in #ASEChat (Monday 8pm on Twitter), join a webinar and add to the chat, attend a TeachMeet (or even present at one), attend a conference and ask a question or chat with a new person over coffee, join a region committee or even a national one, share your expertise, or respond to a survey and get your voice heard.

Whoever you are, whatever your background and experience, wherever you live and work, there is a place for you in ASE.

Remember, #WeAreASE!

Helen Harden is Chair of the Association, 2022/23.

New Chair of ASE's Publications Specialist Group



We are delighted to announce that David Allen has been appointed as the new Chair of the ASE

Publications Specialist Group, commencing his term this summer.

David is currently an associate professor at the University of Hertfordshire, teaching primary science and art to the undergraduates and postgraduates. He has been a member of the ASE Primary Committee and Primary Science Editorial Board for quite a few years. He has a keen interest in educational publishing and is a published author himself, having co-written *Science Meets English* (with Naomi Hiscock) and *Superhero Scientists* (with Alex Sinclair) through

Millgate. David says: *'I am really excited to be taking on the role of Chair of Publications here at ASE. Our journals and publications are a key part of our membership offer and I firmly believe they have a huge impact on the world of science education. I am looking forward to working closely with the team at Headquarters, the editors and editorial boards to look for ways to enhance our publications and take them to a wider audience, hopefully raising greater revenue for the ASE.'*

Improving subject knowledge and confidence in teaching physics



Recruiting physics specialist teachers is an ongoing challenge; more teachers are coming into the profession without a physics degree but are having to teach physics through to Key Stage 4 (age 14-16). The Subject Knowledge for Physics Teaching (SKPT) programme aims to support these non-specialist teachers to develop their subject knowledge and to consider effective pedagogical approaches.



take time to implement this into their teaching. Developing their pedagogical approaches, with support from a physics specialist tutor, can have a direct impact on the quality of teaching in the classroom.

The pivotal role of the teacher in stimulating an appreciation of physics in their students and encouraging a desire for further study cannot be underestimated, yet the fact that many non-specialist teachers who have responsibility for teaching the subject approach it with 'dread' signals a real issue for physics education. Subject specialist CPD that encourages reflective practice is of vital importance to upskill and build the confidence of teachers of physics. The Ogden Trust aims to support all teachers delivering physics in the classroom through a range of programmes and CPD offers, including the SKPT programme.

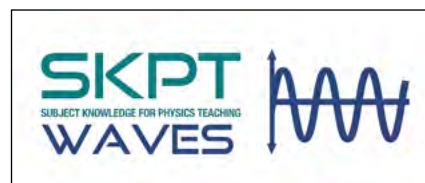
'The feedback from participants has been overwhelmingly positive', confirms Head of Teacher Support at the Trust, Charley Phillips. 'It is great to know that so many science teachers will be returning to the classroom this September with new-found knowledge and confidence in delivering physics. Supporting teachers to be more confident in their physics delivery will enhance the science education that students receive in schools and, ultimately, inspire a passion for science in those young people.'

'The delivery of the SKPT course has been brilliant', says Helen Assinder, teacher of science at La Retraite Roman Catholic Girls' School. Helen is a biology teacher who has recently returned to the classroom – she wanted to develop her confidence to teach beyond her specialism and signed up for SKPT. 'The in-person sessions and all the support online has been thought-provoking and enabled me to reflect on my current strengths and weaknesses and to approach improvement head-on.'

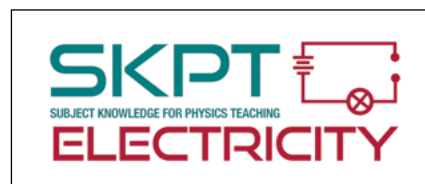
Engaging in the programme over eight weeks, including face-to-face and online sessions, enables participants to fully reflect on the learning, and

will be launched at one of four CPD conference days that will bring the topic to life with hands-on practical sessions.

Book now for waves:
<https://bit.ly/3R2cOUo>









Book now for electricity:
<https://bit.ly/3dPcHNT>



'The [forces] course has been insightful, as it made me reflect on my current practice, significantly improve my own physics subject knowledge, and helped me prepare for the next academic year when I will be teaching physics at both Key Stage 3 and Key Stage 4' (Aida Blentic, Chingford Foundation School).

The SKPT programme comprises six modules, which can be taken individually or built up as a professional portfolio.

For more information, please visit www.ogdentrust.com/SKPT or e-mail skpt@ogdentrust.com

October – December 2022	February – April 2023	May – July 2023
<p>ELECTRICITY</p> 	<p>MATTER & SPACE</p> 	<p>ATOMIC PHYSICS</p> 
<p>WAVES</p> 	<p>ENERGY</p> 	<p>FORCES</p> 

Teaching learners with special educational needs and additional support needs

Consistency

Compiled by Rob Butler

These teaching suggestions came out of a number of discussions of the Inclusive Science Education Group.

Consistency is important in all aspects of teaching and is one of the most powerful strategies that any teacher has in their toolbox. Consistency is key in supporting learners' behaviour, for example, in the way that you respond to learners, or by using a seating plan (seating plans can change for different activities) so that learners consistently sit in the same places (or the places in which you want them to sit). Our more anxious and neurodiverse learners know what to expect in lessons from a consistent teacher, rather than experiencing anxiety where there might be uncertainty around routines and seating.

Having a routine for practical activities is good for all learners and removes anxieties/ambiguities over who does what when getting things out or putting equipment away. Organisation is keeping your equipment in clearly defined places (maybe labelled) so that learners know where to find them.

Many learners don't like uncertainty and so familiar, predictable routines remove some of their worries about science. One of the participants in the Group went on to explain how she structured her lessons to have three familiar components with a corresponding symbol on the screen. Clear signposting within lessons is recommended, maybe with timing (when transitions happen, for example from talking to doing) so that learners know what is coming and when an activity/lesson will end.

Another member of the Group tried to include more consistency in her lessons in response to hearing how this teacher structured their lessons. This teacher introduced a set order for parts of the lesson, for example highlighting parts where students would ask questions. Since trying this strategy, the teacher observed reduced anxiety and an increased willingness to take part in lessons and so the learners were more engaged. Whilst this teacher worked within a special school, there may be groups of learners in a mainstream setting for whom this strategy might work.

Another delegate shared a technique that worked with their dyslexic learners. When introducing a BBC Bitesize video on monoclonal antibodies, which contained a lot of information and terminology, the teacher wrote key points on a mini-whiteboard and asked the learners to draw pictures to show the key facts. The learners almost got it, so the teacher used a physical model to act out the stages of injecting a mouse to get antibodies produced. To complete the learning cycle, our teacher played the video into Google Docs (this technique works with Microsoft Office too) to get a transcript of the video, and then highlighted the key words in bold and asked the learners to read through the text. The learners were asked to summarise the key points into a revision card. From being unable to understand the video at the start, the learners then had a good grasp of key points. This helped to remove the barriers associated with auditory processing.

Having two devices makes the process simpler and, although it might sound relatively 'low tech', you get better results by playing on one device and recording on the other.

Another teacher had experienced success using voice memos on devices, which can help to capture students' thoughts and ideas when they have difficulty writing (they can even dictate punctuation, for example 'full stop'). There is another useful feature in Word: if you go to review and read aloud, Word will read back what you have written, which can be useful when proofreading or preparing a talk.

These strategies remind us that teaching learners who have additional needs isn't about changing what you do, but about making tweaks to overcome barriers to learning.

The Inclusive Science Group is made up of interested educators from all phases and sectors who have an interest in teaching students who have additional support needs or special educational needs. It is organised by Rob Butler from ASE and Dr. Jane Essex (ASE and RSC member), who both have an interest in this area of science education. Membership of this group is open to anyone, and attendance at the meetings is optional. Notes taken during the discussion will be shared with the whole group. You can join by filling in the form at <https://www.ase.org.uk/ise>

ASE Annual Conference 2023: Perfect for Early Career Teachers!

The Friday of ASEConf is always a busy, bustling day of workshops, talks, lab sessions, exhibition and panel sessions. This year we have also added a special one-day conference designed with Early Career Teachers in mind, generously sponsored by the Royal Society of Chemistry.

So, whether you are a trainee teacher, or in your first two years in school, come along to our ECT Extravaganza on Friday 6th January, where you will get advice and support on how to survive and grow your practice from experienced teachers on our 11-19 Committee, look at challenging misconceptions and best approaches to practical work with authors from our recently published *Teaching Secondary Biology, Physics and Chemistry* books, and engage with leading researchers and practitioners on assessment, novel and effective activities and practical work.

You are welcome to select from any conference sessions flagged as particularly relevant to ECTs, as well as the dedicated sessions listed here, or dip into other sessions on the main programme (see the Sched link later in the article), and visiting the amazing exhibition is a must for exclusive giveaways. At lunch, sponsored by the Royal Society of Chemistry, ECTs are encouraged to mingle and network and meet our ASE Chair Trio, Field Officers and committee members. This is your opportunity to meet some of the leading folk in science education and begin to form friendships with science teachers that will extend way beyond one day's professional learning.

If you already have ASE ECT membership, then attendance at ASEConf2023 can be free for one day.

If you are not an ASE member, we are offering a day at Conference from £245 in the knowledge that you are very likely to join once you sample how beneficial and inspirational Conference attendance can be. ASE Early Career Teacher membership starts from £24 p.a., which includes a free day at an ASE conference of your choice – go to <https://www.ase.org.uk/individual-membership> for further details.

Friday's ECT programme

08.30 Keynote for ECTs: *Finding your feet in your first few years*

09.30 *Interesting activities for physics / chemistry / biology*

11.00 *Teaching Secondary Physics / Chemistry / Biology (sessions presented by the books' authors)*

12.00 *Teacher wellbeing and how ASE can help*

13.00 *ECT Lunch, sponsored by the Royal Society of Chemistry*

14.00 *Supporting your development as an early career teacher*

15:00 *ECTs refresh and mingle with ASE Field Officers and committee members*

15.30 *Three sessions on BEST, Practical Work and Teaching for Sustainability*

16.30 *Classroom Assessment and all that jazz*

The above dedicated programme has been curated specifically with Early Career Teachers in mind, but additional sessions suitable for trainees can be found on the live digital link: <https://2023aseannualconferenceshu.sched.com/overview/audience/Trainees>

Look out for more details about further ECT sessions in November *EiS* and, in the meantime, keep checking the ECT timetable on Sched.

Links to tickets are on the ASE Conference 2023 webpage at: <https://www.ase.org.uk/events/ase-annual-conference-2023-sheffield-hallam-university>

For queries, please e-mail conferences@ase.org.uk

Annual Conference support for trainees

John Barker generously left a large donation in his will to ASE (see page 4) and, in response, ASE is offering support for 3 trainee teachers to attend ASEConf2023. Trainees must be ASE members and this provides a free pass for one day of Conference. The financial support being offered in response to John's legacy will provide up to £150 towards any travel or accommodation costs for 3 science trainees who are attending conference on any day from 5th-7th Jan 2023. In the first instance, application for funding should be made via angelabuckland@ase.org.uk and received by 24th October. Please provide your details, including where you are doing your ITE course, and up to 200 words outlining how you believe attending ASEConf2023 will benefit your teaching and professional learning. If you are successful, you will be notified by the end of October 2022 and, after Conference, asked to write a short article for *EiS* in spring 2023, explaining how you found attending the Conference beneficial to your teaching.

Cut Out and Keep: Open evenings

Conduct and observe a range of microscale chemical reactions

Technicians/teacher notes

Any of these reactions can be substituted but a full risk assessment needs to be completed and you need to be confident that any substitutions are safe for the intended audience, which in the case of an open evening could be very young children. Well-fitting eye protection must be given out on entry to the room where activities using chemicals will take place. This rule should apply to everybody and the management of this included in your risk assessment.

It is good practice to only allow children to participate in chemistry practicals on open evenings if they can safely see and reach the lab bench and apparatus.

To ensure tiny amounts of solid are used we cut a wooden splint cut in half instead of a spatula. We put each reactant out in a labelled shot glass with a trimmed down 1 ml pipette already in, half a splint for solids and forceps by the side to pick up tiny pieces of magnesium ribbon.

The laminated sheet can be wiped clean into a bin bag and reused.

Our indicators are in small dropping bottles with the pH range printed on the label.

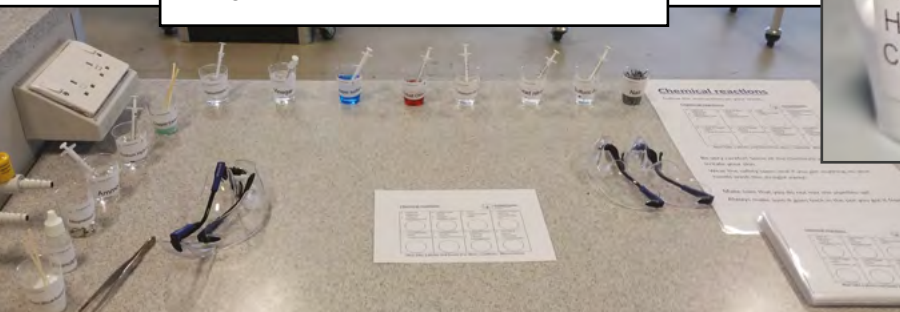
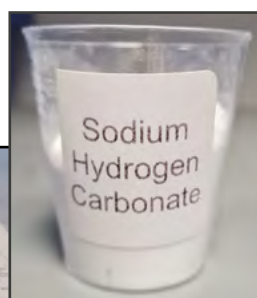
On open evenings we do this with 2 sets of chemicals and allow 4 children to take part at a time, spread out across the bench. A member of science staff is present alongside well-trained student helpers.

Equipment per group

- Microscale laminate
- Magnesium ribbon
- Hydrochloric acid
- Lead nitrate
- Potassium iodide
- Iron nail
- Copper sulfate
- Copper carbonate
- Sulfuric acid
- Ammonia
- Thymol blue
- Bromophenol blue
- Phenolphthalein
- Sodium bicarbonate
- Vinegar
- 7 x cut-down 1 ml pipettes
- Forceps
- Cut-down splints









Method

1. Very carefully follow the instructions on the laminated sheet.
2. Be very careful! Some of the chemicals are dangerous.
3. If anything gets onto your skin, wash your hands immediately.
4. If anything goes into your eyes, tell a member of staff, who will eye wash immediately.
5. Observe the results, has a chemical reaction taken place? How do you know?



Microscale chemical reactions laminate

We use an A5 laminated sheet with clear instructions as shown, and a circle for them to conduct their reaction in.

<ul style="list-style-type: none">• 1 piece of Magnesium• 1 drop of Hydrochloric acid 	<ul style="list-style-type: none">• 1 drop of Lead nitrate• 1 drop of Potassium iodide 	<ul style="list-style-type: none">• An iron nail• 2 drops of copper sulfate 	<ul style="list-style-type: none">• A tiny bit of copper carbonate• 1 drop of Sulfuric acid 
<ul style="list-style-type: none">• 1 drop of ammonia• 1 drop of Thymol blue 	<ul style="list-style-type: none">• 1 drop of bromophenol blue• 1 drop of sulfuric acid 	<ul style="list-style-type: none">• 1 drop of ammonia• 1 drop of Phenolphthalein 	<ul style="list-style-type: none">• A tiny bit of Sodium bicarbonate• 1 drop of vinegar 



Health and safety notes

Eye protection must be worn at all times during this experiment and by everyone else in the room.

A risk assessment must be completed, and consideration given to the audience and others in the room.

Magnesium ribbon – 0.5 cm - Flammable – Wear eye protection

Hydrochloric acid – 0.5 M - Currently not classified as hazardous at this concentration – Wear eye protection

Lead nitrate – 0.015 M - Currently not classified as hazardous at this concentration – Wear eye protection

Potassium Iodide – 0.1 M - Not currently classed as hazardous – Wear eye protection

Iron nail – May be sharp, take care and use forceps – Wear eye protection

Copper sulfate – 0.1 M - Warning Irritant to eyes and skin – Wear eye protection

Copper II carbonate – Harmful if swallowed. Causes skin irritation. Harmful if inhaled. Very toxic to aquatic life with long-lasting effects. Causes serious eye irritation. Causes serious eye damage – Wear eye protection

Sulfuric acid – 0.5 M - Warning Irritant to skin and eyes – Wear eye protection

Ammonia solution – 0.5 M - Not currently classed as hazardous – Wear eye protection

Thymol blue – 0.04% - Not currently classed as hazardous. Check manufacturers' SDS as indicator recipes may differ. Contains less than 20% Ethanol so not considered flammable – Wear eye protection

Bromophenol blue - 0.04% - Not currently classed as hazardous. Check manufacturers' SDS as indicator recipes may differ. Contains less than 20% Ethanol so not considered flammable – Wear eye protection

Phenolphthalein – 0.1% - Premade solutions are not currently considered hazardous. Check suppliers' SDS sheets before use

To make – Dissolve 0.1g of solid phenolphthalein in 60mls of ethanol. Top up to 100ml with water. Pure phenolphthalein is toxic and ethanol is flammable. Do this in a fume cupboard wearing gloves and away from any naked flames – Wear eye protection

Sodium Bicarbonate – Low hazard – Wear eye protection

Vinegar – low hazard. Standard vinegar is around 0.8 M if substituting with ethanoic acid use 1 M which is also classed as low hazard – Wear eye protection

Open evenings: Energy sticks – A way of bringing physics to open evenings

John Hemmings, Accrington Academy, writes:

Open evenings are often a pain for science departments, which try every year to find something that Year 6 (age 11) pupils and their parents will find interesting and engaging. Here at Accrington Academy we haven't usually had any problems with activities for biology or chemistry and we have described some of these in previous articles.

The problem has usually revolved around physics. We have struggled when it comes to finding something even vaguely interesting that relates to physics. Over the years, we have tried all sorts of activities. One year we made the mistake of dusting down and demonstrating our Reubens Tube. The result was an average room temperature of 40°C and an overheated, frazzled physics teacher. Worst of all, the demonstration involved playing one tune, 'Seven Nation Army', continuously throughout the evening

(I still get flashbacks when I hear that song).

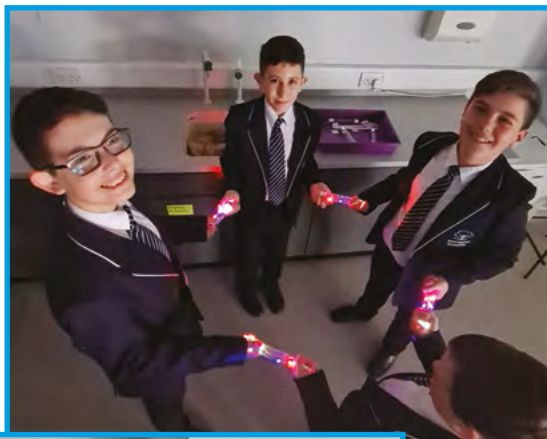
A solution came about a few years ago when, after a demonstration, we bought in a few energy sticks from Amazon (currently available for around £12 each). If you're not familiar with energy sticks, they consist of a clear Perspex tube, around 15 cm long with foil at each end and a line of LEDs inside. When a circuit is completed, by simply holding each end of the tube, the LEDs flash and a whirring, buzzing noise is emitted.

We have had these on display at open evenings for a number of years and they are a great way to gain attention while also giving a very basic introduction to electrical circuits.

The usual way is to have a few energy sticks on a bench and for the pupils to start by connecting the terminals individually, and then progressing to chains of people with one or more energy sticks in the chain. With the energy sticks containing LEDs, it is important that they are correctly aligned in these multiple circuits.

Circuits can then be made with various combinations of pupils, parents, teachers and energy sticks to make a variety of circuits, starting with one stick and a chain of people and then progressing to energy sticks in series.

This can be developed further using a variety of metal and plastic rods

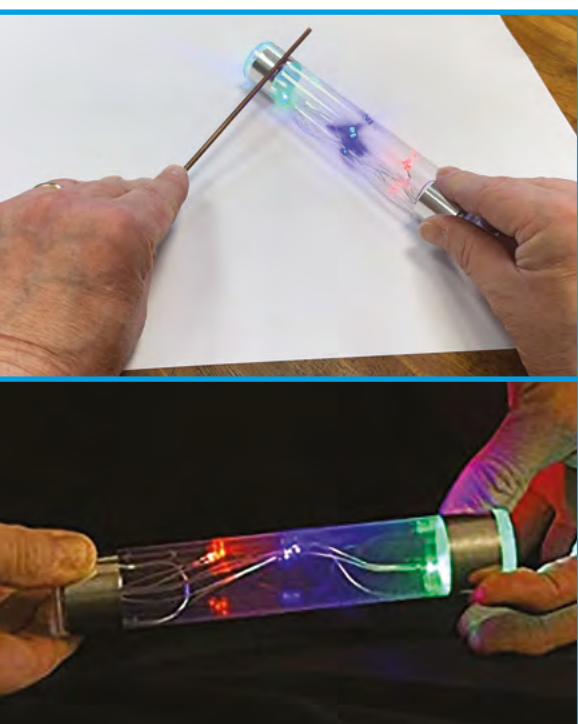


to demonstrate conductors and insulators, including having water on a bench to complete a circuit between people.

The demonstrations don't last all that long, but the noise and light is perfect for grabbing attention using physics. People can then move on to other demonstrations in the area.

Overall, we have been impressed with energy sticks and would recommend them to anyone looking at bringing more physics into open evenings or introducing electrical circuits at Key Stage 3 (ages 11-14).

Safety Note: These energy sticks have internal batteries and should always be used as recommended by the manufacturer.



Show my Prep Room

**Sharon Fraser and Nicola Hatton,
The Ladies' College, write:**

We had our prep room redone in the summer holidays last year and we really like it.

When we first saw that cupboard doors had been put on the Gratnells storage units, we weren't sure that this was going to work. We thought that it would be awkward and that the doors would be in the way. However, there are only two of us and actually we think that the doors make it look neat, plus we've never got in each other's way.

We have two Gratnells sections for practicals that are ready to go out. These are mainly chemistry and biology practicals, as all physics equipment is stored in the labs. Basic glassware, Bunsens, etc. are all stored in each lab, so our prep room mostly contains



bench chemicals. Usually there's only one tray per experiment, so we find the two sections adequate. Again, we can prepare practicals in advance and keep them in the racks out of the way with the doors closed (see photos).

The other photos show our chemical storage for bench chemicals, with solids at the top (yellow trays) and liquids at the bottom (green trays). We have bought Gratnells inserts for both: foam ones for the dropper bottles and trays



for the solids, which nicely hold the 5 or 6 film canisters/pots that we keep for each chemical.



New awards for CSciTech and RSciTech

We are proud to announce the following awards, granted since May 2022.

CSciTech

Samuel Boadi
Kathryn Jagger
Bethany Patience

RSciTech

Sarah Porteus
Kim Treacy
Laxmi Gharti Magar
Sharon Nicholson

Goodbye and hello from the ASE Technicians Committee!

ASE is extremely grateful to Jodi Clements, who has looked after the EiS Prep Room contributions for a year and has brought in some exciting new features for the section. We will miss you, Jodi! – Ed.

Jodi Clements RSciTech writes:

After almost 3 years on the ASE Technicians Committee, and a year compiling the Prep Room section of *EiS*, it's time for me to say goodbye! I have taken on a huge new role serving my community as a ward councillor, so, to be successful in that, I've had to put down a few of the plates that I've been spinning over the years...sadly including this.

I'd like to thank the Committee; they are like a science family with so much knowledge and experience in every aspect of what we do as technicians. Each and every one of them has a different background and skill set that makes for perfect teamwork. I had some fantastic times and so many laughs with them – I really will miss being part of it.

I've also thoroughly enjoyed being part of the ASE Registration Board, which



Jodi at work

assesses RSciTech applications. I've learned so much from this process and have been inspired by some of the work of other technicians.

I would urge anyone who is interested to consider joining either the ASE Technicians Committee (they're amazing), or your ASE regional committee. It's been an enjoyable experience for me; I've made some great friends and have been involved in some brilliant meetings and conferences, as well as making so many important connections in the world of science education.

I'd also like to ask you to write! Do you do something different? Something you're proud of? Have a method or a tip that you'd like to share? Send it in with a few good photos. Technicians love to see what other technicians are doing, especially lone technicians who can't get out much. The Prep Room section of this magazine is all about showcasing what you do and inspiring and informing others.

Show us your prep room too! Are you proud of your prep room? What systems have you developed? Any little storage tips? Why not show us all here?

Please do support the ASE by getting involved, they're a brilliant team and one I'm sad to be leaving.

Also, I'd like to thank you all for reading The Prep Room and for some of the responses to the articles that I have written. I may still write some 'cut out and keep' practical sections in the future, as these have been very well received and I've enjoyed doing them too.

So, it's goodbye! for now...

Jodi Clements RSciTech

Not really a goodbye...to Jane Hanrott



In June this year, Jane Hanrott, former ASE Journals Co-ordinator,

left the employ of ASE after 37 years. However, she is continuing to work on a freelance basis on the production of

ASE journals and books, as well as project-managing *EiS* and, for a while, assisting with SSR admin.

ASE marked this occasion with a presentation at the July Staff Meeting at Headquarters, and Jane wished to share this brief message:

I would just like to say a huge thank-you to everyone who gave me such a

wonderful 'send-off' in July and who presented me with a beautiful garden bench and parasol, both of which are already in use. I was very moved by everyone's generosity and will always think of ASE in years to come when I'm sitting on and under them, looking down the valley to the sea.

And thank you, ASE....for everything!

Failure – Find comfort to get better and develop your service along the way

William J. Hoar RSciTech, TMIET

Learning from failure is something that we are all aware of as a concept. Do we do it enough though? If you try something and it fails, do you try again and again until you succeed? Or do you put it behind you and move on to the next thing?

In a safety-critical environment (science lab, healthcare, aviation), you only want to err once. And, if at all possible, correct that error before it can cause harm, at the near-miss stage instead of post-accident. This can only be done in a safe, non-judgemental culture, a learning culture. Where blame is feared, mistakes increase as people do not learn from each other – they have to make all the mistakes themselves before improving their practices. In an open culture, everyone shares their mistakes and best practices with each other, so mistakes only need to be made once before everyone can improve their practices. This impact is even greater if mistakes and best practices are shared widely between similar settings or organisations.

How do children learn to walk? Do they try once, not succeed and never try again? No. They try and fail and try and try and try again. The important thing isn't that they fall over at the end of an attempt, but that they get a little bit further on each occasion or learn what not to do next time.

Getting better is important; believing that you're the best is close to pointless. If you're the best now and times change (they will), while you stay still, you suddenly appear to have gone backwards relative to others. The others keep getting better at what they do and they surpass you, just because

time has marched on and they've applied a growth mindset throughout.

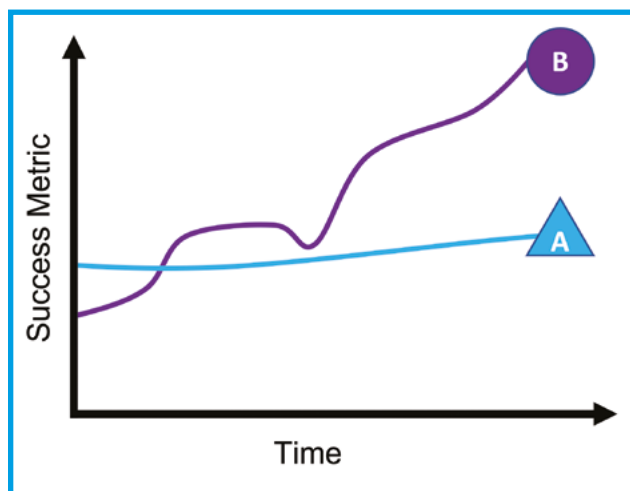
Always try to get better; never try to be the best. Trying to get better = Growth Mindset; Trying to be the best = Fixed Mindset.

'A' and 'B' in the Success Metric diagram could be a person, function, service or organisation. 'A' has a fixed mindset and focuses on how it is the best. 'B' has a growth mindset and focuses on always getting better and their trajectory takes them beyond the success of 'A'.

I recommend watching the Netflix film *The Wall: Climb for Gold* to see how comfort with failure affects performance in an elite, high performance environment.

I'm not 100% comfortable with failure; no one ever is. In fact, quite the opposite at times. I have beaten myself up about it and occasionally I still do. I'm fairly sure that we all have. Has it ever helped me? No.

The pivotal first step to becoming more comfortable is to change your perception of failure from how much you failed into what success you had, and what you learned to do and not to do in the future. A task is never solely failure or only success, as success and failure are not binary. Taking a step away and keeping reviews objective about routines and processes make it easier to accept the learning points



and still improve the outcomes. Reflect, and ask what should change and what should stay the same. Most critically, do something with this information to prevent a repeat!

For instance, the Phenolphthalein agar practical to illustrate diffusion has a fairly set process. If you boil the agar to get it to set, with the alkali in, it goes black and is unusable for the practical, but would be set when cooled. We might do that once, but we wouldn't intentionally repeat that in the future. We'd boil the agar so that it dissolves and gels and make the molten agar alkaline once it had cooled a little. We've learned what not to do. The first attempt was not 100% success and was not 100% failure.

Not fully succeeding at what you set out to do is not total failure. Failure is rarely, if ever, total. The only guaranteed total failure is when you fail to learn from the experience that you have undergone.

Will Hoar is a science technician based in Liskeard, Cornwall.
E-mail: will.hoar@outlook.com



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ASE Annual Conference 2023 at Sheffield Hallam University

Thursday 5th to Saturday 7th January

Our Annual Conference in 2023 runs over 3 days in January and incorporates sessions chosen by various ASE committees who have selected the workshops and talks. The underpinning themes for 2023 are *Assessment, Curriculum, Diversity, Professional Journeys, Research, Sustainability and Environment, Vocational or Other* (Frontier Science sessions are separately tagged accordingly). For 2023, sessions of international interest are incorporated throughout the 3 days of the event, tagged as *Global Science* if selected by the ASE International Committee.

The live online digital timetable can be viewed on our Sched link below. For 2023, a select number of sessions will be broadcast by live-streaming and ticket types available include an option to view those sessions only, recordings for which will be available for a limited time in early 2023. For further details and regular updates to the timetable, keep an eye on:

The webpage at <https://www.ase.org.uk/events/ase-annual-conference-2023-sheffield-hallam-university>

Our live digital timetable, Sched, at <https://2023aseannualconferenceshu.sched.com/>

Some of the highlights so far include:

Throughout the Conference

Incorporated throughout our annual showcase event will be a mixture of inspiring and thought-provoking topics

to stimulate science learning and education for all sectors, including the ASE Presidential Address, keynotes, panel debates, receptions and book-signings, as well as:

- **Frontier Science lectures:** Focusing on areas of expertise within Sheffield Hallam University, these sessions are delivered by leading researchers. Grab the opportunity to make some scientific links for you, your school and your students.
- **Global Science sessions,** selected by the ASE's International Committee.
- **Exhibitors:** Exhibitors, including publishers, manufacturers, suppliers and awarding bodies will occupy Hallam Hall and the mezzanine of Hallam View in Owen Building, showcasing their latest offers and including giveaways, some of which will be exclusive to Annual Conference. ***At the time of writing, approximately 85% of stands are already sold, so anyone interested in exhibiting should e-mail katherinegisby@ase.org.uk as soon as possible.***

For 2023, we also have an **inflatable brain** provided by the team from Secondary Education around Early Neurodevelopment (SEEN) and **Starlight STEM's planetarium**, on show in the STEM Atrium.

- **The ASE Hub** will be located within the exhibition space. Pop by for a chat about anything ASE: membership, resources, find out who is who in your region, how to write an article in a journal, how to join a committee... ask anything!

Thursday 5th January

- **Post-16 Day:** a dedicated series of sessions for Key Stage 5 (age 16-18) science education throughout the day – keep an eye on the [Post-16 timetable on Sched](#).
- **Presidential Address:** Join Professor Michael J. Reiss as he highlights some of the initiatives facing the science education sector today.
- **Evening Social:** Street Food and Swing Youth Jazz Band in the Heartspace Atrium – places are limited, so don't forget to book your ticket on Eventbrite.

Friday 6th January

- **Technicians Day:** We are delighted to be offering a dedicated programme for technicians on Friday. Topics including microscale chemistry, leadership, Health & Safety and *Drosophila*, along with others to be confirmed, will be on offer, with the use of labs for a number of practical demos. Keep an eye on the [technicians' timetable on Sched](#).
- **Schools Exhibition:** ASE's ever-popular event takes place from 09:00 to 12:00. This is a showcase of projects, artefacts or posters and ideas from schools from all sectors who wish to share a topic with the science education community. Anyone wishing to participate should complete the entry form (**ideally by 9th October**) at <https://www.surveymonkey.co.uk/r/AC23SchoolsExhibition>. Schools' names will be published in the Conference Handbook if notified by the end of November 2022.

● **Early Career Teacher Day:** A timetable of sessions dedicated to trainee teachers and newly or recently qualified teachers, through generous sponsorship from the Royal Society of Chemistry, has been co-ordinated for those at the beginning of their science teaching career pathway. Simply use the [ECT timetable on Sched](#) (which has been tagged 'trainee') as a starting point. Small changes may occur, so keep a close eye on developments! **See more on page 11 of this issue of EiS!**

● **Primary Swap-Shop Pops Up:** The newly titled Primary Pop-Up takes place at 14:00 for any primary

educators wishing to pop their project or artefact onto a table top for discussion and networking with others. Anyone wishing to join in should e-mail helenrspring@gmail.com in the first instance.

● **Evening Social:** ASE's Party in the Atrium takes place in the Heartspace Atrium, with a pop-up bar, music, dancing and light bites – places are limited, so don't forget to book your ticket on Eventbrite.

Saturday 7th January (final sessions end at 16:15)

● **Research-based sessions,** led by Colin Forster keynoting on how to

implement a research-informed change to your classroom practice.

● **Ofsted Keynote:** Join Jasper Green HMI as he offers the latest key insights from Ofsted's science subject report.

● **The ASE AGM** takes place at midday for ASE members to transact their annual business.

● **Primary TeachMeet** takes place at 13:00.

We sincerely hope that you will join in our annual flagship event and leave with new ideas and connections to enrich and further develop your science expertise!

Other ASE events in 2022/23

ASE has a number of events planned, including online CPD, webinars and face-to-face meetings, to support science teachers and technicians. Please browse the events list below and keep an eye on our website for the most up-to-date news and information at: <https://www.ase.org.uk/events> – we are delighted to also be co-ordinating many regional face-to-face events, some of which are listed below and all will be published on the webpage as they evolve!

September

27th Sept: Introduction to professional registration – [Online](#)

28th Sept: RSciTech session to find out more – [Online](#)

28th Sept: ASE Cymru Teachmeet and Networking
Cardiff Metropolitan University,
CF23 6XD

29th Sept: Technicians Leadership: Leading yourself and your team – [Online](#)

29th Sept: CSciTech: Find out more – [Online](#)

October

6th Oct: Technicians Getting Started – [Online](#)

8th Oct: Biology Subject Knowledge Workshop
Reigate Grammar School, RH2 0QS

11th Oct: ASE Primary Workshop: Meet the authors – [Online](#)

13th Oct: Technicians Leadership: Working with and training others – [Online](#)

19th Oct: TechMeet Cymru: an online networking meeting for technicians – [Online](#)

20th Oct: Practical Biology for Technicians – [Online](#)

November

10th Nov: Technicians Leadership: Organising your technical service – [Online](#)

12th Nov: West of England Science Convention – [Open to all](#)

17th Nov: Practical Chemistry for Technicians – [Online](#)

December

1st Dec: Technicians Supporting Students – [Online](#)

8th Dec: Practical Physics for Technicians – [Online](#)

January 2023

5th-7th Jan: ASE Annual Conference
Sheffield Hallam University, S1 1WB

Ideas for delivering useful practical science CPD – A collaborative process

Jodie Stuart

An article summarising our methodology for delivering best practice when teaching science practicals: a structured approach that allows all staff within the department to learn from each other, regardless of experience.

Introduction and context

Science is a practical subject – we use it to aid the learning of scientific concepts and to help our students to develop skills that can be used later on in employment. Ideally, we want to inspire our students to be open to a career in STEM subjects. In order to do this, it is important that we, as teachers, deliver good practical science. With a shortage of science staff, new teachers could be non-experts, could have taken a pathway where their exposure to laboratory skills is limited, or they could be following a teaching programme that requires them to teach with limited supervision. This could result in practicals being avoided, as teachers may lack the skills or confidence to carry them out.

Within our department, the Head of Department was also re-sequencing the science curriculum and we wanted to ensure that meaningful practicals remained a priority. Below is an account of the action taken.

Starting point

First, we signed up to a project called *Keeping Science Practical*, run by the Association of Science Education (ASE) based on the Gatsby *Good Science Practical* report. It should be noted that this project looks at involving

technicians as well as Early Career Teachers (ECTs) and more experienced members of staff.

From this, it was possible for the project leader (myself) to develop good practical Continual Professional Development (CPD) training for staff. In a weekly timetabled session during a 20-minute briefing, the Project Manager would facilitate an interactive session to look at the purpose of different practicals and how they would typically be carried out. This was important, not only to pass on information, but also to achieve staff buy-in.

By the end of these sessions, we came up with three main reasons as to why we carried out practicals. Staff were asked to use these criteria to inform their planning. Interestingly, the three reasons were very similar to aspects of the *Good Science Practical* report. The reasons are referred to by the team as A, B or C:

- A – to develop students' scientific understanding through investigation;
- B – to demonstrate an understanding of a scientific concept and review evidence based on what is already known; and
- C – how to use laboratory equipment and how to carry out practical procedures.

A typical practical science lesson

Next, the team worked together to produce ideas about what a typical practical science lesson should look

like. This is basically a checklist of everything that it was felt should be included in a practical lesson. We also have one of these for typical (non-practical) science lessons. Once every 6 months, the Assistant Head of Science produces a rota and either they or the Head of Department carry out a paired observation with another team member (using the checklist). This lasts for 20 minutes. At the end of the session, the teachers observing discuss what they saw and give feedback. Ideally, newer or less experienced members of the team should observe more experienced members. This is also an excellent methodology for maintaining consistency among the lessons being delivered within the department. It should be noted that trying to do paired observations specifically on a practical is the ultimate goal, but this can be difficult, given constraints on staff time and position in schemes of work, as the observation needs to coincide with a practical.

Magpie Wander

Paired observations and the problems associated with this are touched on above. In the real world, time is a major limiting factor. Ideally, areas for improvement would be identified sooner.

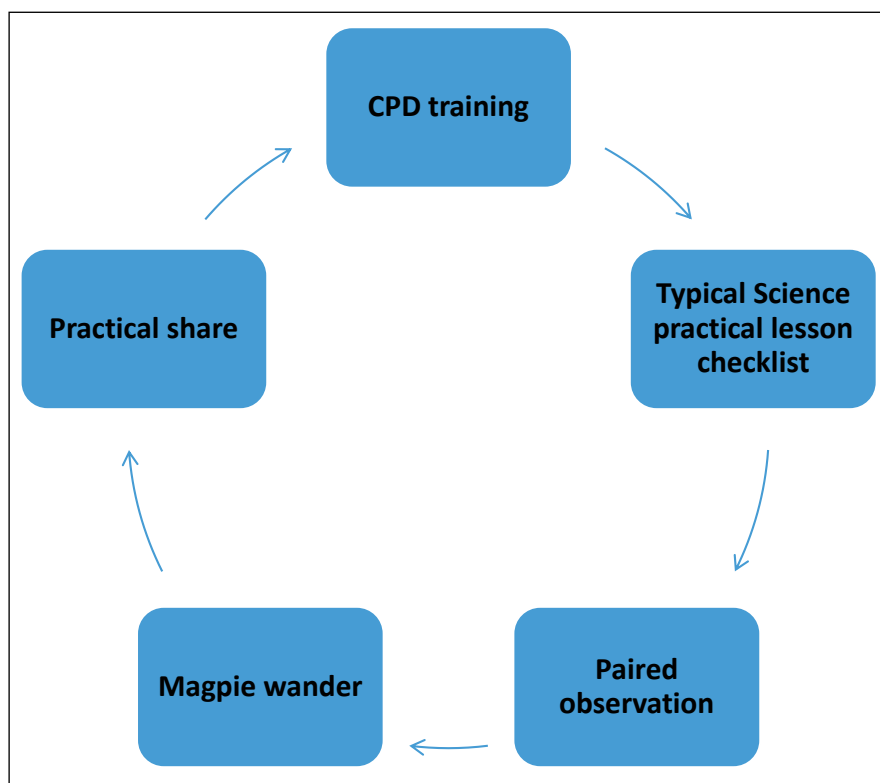
To counteract this, a 'Magpie Wander' is undertaken (this term is not coined by myself) each week. One member of the team carries out a learning walk during a free period. The aim is to visit more than one active science lesson for a short time (between 5-10 minutes). The observer has a standard feedback sheet to complete during

this observation. They are tasked to record two **positive** things that they see in each lesson that they visit. The observer then makes two photocopies of the feedback sheet. They cut the first copy into sections and hand back the feedback slip to the teacher with whom it corresponds. The aim is that this is done by the end of the lesson (immediate feedback). The observer highlights areas of good practice seen to the whole team during Department Briefing the following week. The second copy is then handed to the Assistant Head of Science. Over time, this builds a picture and, together with the paired observations, enables the Assistant Head of Department and the Head of Department to identify areas in both practical and non-practical sessions that could be developed further. It also helps to inform the content of the next CPD session.

Experienced and newer members of staff are able to gather ideas from colleagues. The positive comments about lessons work well to improve morale and confidence in teachers, irrespective of the level of their experience.

Practical share

In the second weekly timetabled 20-minute department briefing session, one member of the team carries out what we term a 'practical share'. This is a sharing of ideas with the focus being on practicals. To do this, the Assistant Head of Science produces a rota where each member of the team, including technicians, has a time slot (one per term) to share good practice. Importantly, it is discursive and wide-ranging, e.g. from how the technician would like the practical trolley to look at the end of the lesson, to experienced teachers going over misconceptions that students may have in practicals. There are hints and tips for new staff with regard to basics such as laying out equipment around the lab, plus some



time for staff to ask questions about what had just been shared. This has the capacity to work in many different aspects of the department's work; for instance, we also use the same concept to carry out homework shares or other areas of development.

Impact

Below is some subjective feedback from staff indicating the impact that the CPD has had on their practice:

'As a Head of Department...the use of dedicated department time to focus on practicals was incredibly useful and ensured that there was consistency and purposefulness in our approach to experimental work. The weekly CPD and collaborative approach was fundamental to the departmental "buy-in" to what we were trying to achieve' (Kirsty W.).

'As someone who has been teaching for almost 20 years now and for most of that time as a pastoral leader, it is easy to fall out of touch with current (and best) practice...The science practical lessons have made me think carefully about the purpose and structure of the

lessons when we are doing a practical – what is it that I want them to get out of this? Why are we doing it this way? Is it clearly linked to the lesson objective? The...share sessions are also very helpful. They help build variation to keep students motivated and also, because we are timetabled to share, it keeps us accountable by ensuring that we are always reflecting on our practice and looking for new and improved methods of delivery' (Michael S.).

'The "Keeping Science Practical" CPD has helped give structure across my practicals, providing consistency, and allowed me to explicitly explain to students the intent (A, B or C) of the practical, letting me assess their knowledge within that framework afterwards; for example, focusing on evaluating the practical and how to improve the practice of it' (Georgina B-J.).

'It has been genuine CPD on ways to improve quality of teaching and learning, which has the greatest impact upon results...Practicals can traditionally be a "nice lesson filler" that we know students enjoy and saves teachers having to battle theory work.

This CPD focuses on the importance of well-planned practicals having a really clear purpose to embed the theory. The practical needs to drive the learning objective' (Dan P.).

'Being more mindful about my planning – when/how/why I am selecting to use a practical in my lessons' (Coralie C.).

'Using the resources/experience shared by other teachers on the session also helped me to get a broad idea on how to carry out science practicals in a more structured way' (YInyi L.).

'The practical share in the briefing has definitely helped me in lots of ways, like what sort of worksheets to use, or how to set it up, what aspect to focus on for a specific practical, etc.' (Ranu S.).

Conclusion

League tables and exam success depend on the written papers; every school wants their students to perform well. The large amount of science content that teachers are required to cover can make it feel as if we don't have enough time to deliver the quality practical sessions that would enhance the students' learning. But we have a professional duty to teach practicals, as they are a fundamental part of science. By looking at ways in which we can keep science practical, such as providing quality training and removing any uncertainties that teachers may have, we can preserve this essential part of science.

Website:

Good Practical Science:
www.gatsby.org.uk/education/programmes/support-for-practical-science-in-schools

Project:

ASE: *The Keeping Science Practical* project.

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Annual Conference 2022 – a celebration part 3

During this year, we have published short accounts of sessions at the 2022 Online Annual Conference – here is one more!

Pupils love molecular models: early exposure of atomism in HEC

Koji Tsukamoto, Haruhiko Funahashi, Michael Malvern Hull, Haruki Abe, Tomoko Hasegawa, Mariko Kobayashi and Noritake Okazaki

Our session at ASEConf2022 was based on HEC, which stands for 'Hypothesis–Experiment Class'. HEC is an approach to science learning advocated by Dr. Kiyonobu Itakura in 1963 in Japan. It is a teaching theory and method that can help students understand fundamental laws of science. You can learn more about HEC in the first English translated edition of Itakura's original papers, published in 2019 (https://www.kasetsu.org/4_english/lit-guide.html#b1902_1).

The Classbook is a textbook and a notebook for pupils. It is also an instruction manual for teachers. Over 50 Classbooks have already been created. Among the many

achievements of HEC, one of the most remarkable is the early exposure of atomism. In 1971, the picture book *If You Could See an Atom* (IYCSA) was published by Dr. Itakura.

IYCSA focuses on the molecules that make up the air and on developing an image of them. IYCSA introduces pupils to the 'atom', which the ancient Greeks considered to be the ultimate indivisible particle that constitutes matter. Then, IYCSA leads pupils to recognise the fact that the world is made up of these atoms through hands-on experiences.

In our presentation, we shared how children's ideas about atoms have been changed before and after the

HEC teaching by showing children's drawings and comments. We have introduced many artefacts created by teachers and students inspired from using IYCSA, including playing cards, cartoons and an interactive e-book. We have also introduced the practice of IYCSA outside of Japan (at the University of Vienna).

If you are interested in IYCSA, you can find the English translated version in the appendix of the book mentioned above. Furthermore, we have published a Kindle book that explains how to conduct IYCSA, drawn in a Manga style. (Please search for *If You Could See an Atom* in Amazon).

Resources

The start of the new school year is here once again and we hope that you've had a lovely, restful summer.

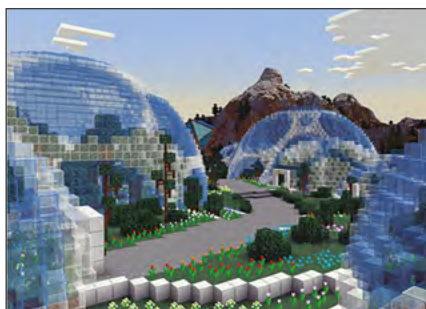
On our never-ending mission to bring you new, curriculum-linked educational resources, we've been working hard with our partners to find resource gaps and to produce the high quality resources that you'd associate with us. To that end, we have many and below are just a few! You can mix and match, use as full lessons or simply utilise for homework learning.

Minecraft

ASE has teamed up with Minecraft to develop a learning activity for students aged 11-13 years.

Students explore key locations in the Periodic Odyssey to collect gaseous and metallic elements, whilst researching their uses and properties. Students:

- Recall the element symbols for the featured elements;
- Research the use of each element and make links to the properties of the element; and
- Describe differences between how the elements are found in the Minecraft World and in the real world (optional).



The Periodic Odyssey and *Element Quest* lesson plans were developed in partnership with ASE.

**Minecraft Element Quest –
Schoolscience.co.uk**

e-Bug

The e-Bug programme, operated by the UK Health Security Agency, has developed and updated teaching resources to educate students aged 3-16 years on infection prevention, control and treatment. e-Bug is a health education programme that equips children and young people with knowledge about microbes; the prevention, spread and treatment of infection; antibiotic use; and vaccination, and promotes behaviour change in these antibiotic users and prescribers of the future.



To download your free educational resources, visit www.schoolscience.co.uk/e-bug

SKPT courses – The Ogden Trust

The Ogden Trust is now delivering Subject Knowledge for Physics Teaching (SKPT) courses: FREE blended learning CPD for KS3 and KS4 (age 11-16) teachers without a physics specialism.

The SKPT programme comprises six topics, with modules available each term. Teachers can select the modules that they need to build their subject knowledge and professional portfolio. Modules will be delivered and supported by physics specialists across England and will include face-to-face sessions, online tutorials and independent learning. Each module will require up to 20 hours of learning and will be completed over approximately eight weeks.

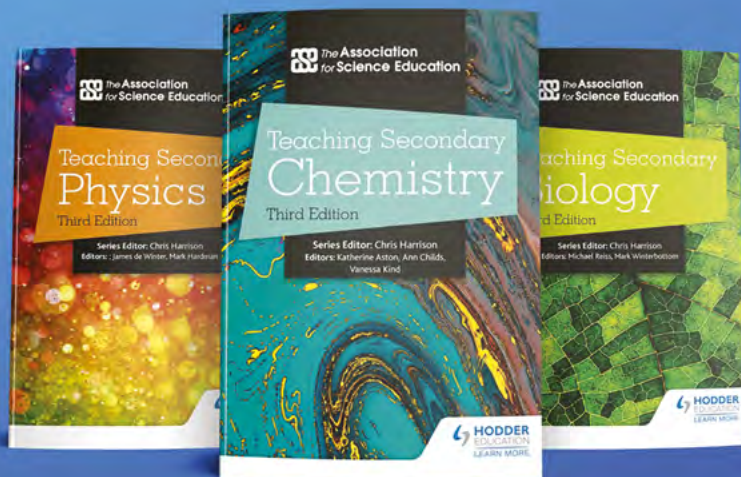
Participants must be state school teachers in England, with some physics on their timetable and must not have a physics ITT qualification (see page 9 for more details).

Visit the Ogden Trust website for more information:

(www.ogdentrust.com/teacher-support/subject-knowledge-for-physics-teaching) or (www.schoolscience.co.uk/subjectknowledgeforphysicsteaching)



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ASE Book of the Year Award 2022

The submissions for ASE Book of The Year have now closed and we want to thank everyone who submitted a publication for review.

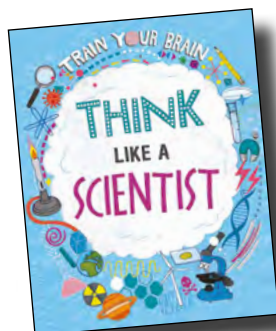
We have received some fantastic entries and our reviewing panel have been busy reading and reviewing all the

submissions. We look forward to announcing the short list in November and the winner will be announced at the ASE Annual Conference 2023 at Sheffield Hallam University!

Previous winners have included:

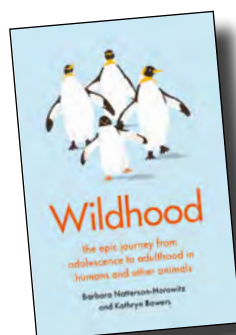
2021: Train Your Brain: Think Like a Scientist

By Alex Woolf



2020: Wildhood: the epic journey from adolescence to adulthood in humans and animals

By Barbara Natterson-Horowitz & Kathryn Bowers



2018: DNA Detectives: To Catch A Thief

By Dr Mandy Hartley



To see all previous winners and finalists, visit <https://www.ase.org.uk/BOTY>

Teach Primary Finalist

SAVING THE PLANET ONE SCIENCE LESSON AT A TIME

We are delighted to announce that Amy Strachan's 'Saving The Planet One Science Lesson at a Time' has been shortlisted for the Teach Primary Awards in the STEM category.

You can see the full short list on Teach Wire here: www.teachwire.net/news/teach-primary-secondary-awards-shortlist-2022/

To celebrate we are giving 10% off the book until October 2022! Just use the code **SAVEPLN22!** at check out.

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Now available on presale!



It Might Come in Useful

By Elizabeth Flinn (author) and Hannah Thompson (illustrator)

The next instalment in the *Stories for Science* series is now available for presale.

Bear saves everything

because he knows it will all come in useful at some point. His collection grows so big that he has trouble finding what he needs. Is there a way he could organise things better?

It Might Come in Useful is an endearing and beautifully illustrated story for children aged 5-7 which sets the scene for science investigations about materials.

The stories do not have satisfactory endings and the characters are left with a problem to solve. After doing some appropriate investigations in science lessons, children will be able to use their knowledge to write a happy ending to the story.

ASE Members £8.50

www.millgatehouse.co.uk/it-might-come-in-useful

All books are available from www.millgatehouse.co.uk

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Once registered, go to the 'my account' section where you will find a menu item that asks 'are you an ASE member'. Click through and complete the form – don't forget to save it! Your details will then be updated, this usually takes about 48 hours.

When your account has been validated, the membership discounts are automatically applied at checkout.

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Improving learning outcomes for science students by focusing on developing their mathematics skills

Richard Needham

Original research

'The skills that students are taught in maths lessons seem to be forgotten when they come into my science lessons' is a typical statement of the type made by many science teachers over the years at ASE meetings and conferences. The challenges faced by students appear to be an increasing problem for many teachers of science as the mathematical demands of the specifications have been given greater emphasis over recent years. The same teachers have become aware that their students have difficulties with a range of different mathematical ideas in science contexts, even when science teachers explicitly address these specific skills in their teaching.

Several years ago, ASE recognised that science teachers needed to be supported by being provided with authoritative guidance on teaching mathematical ideas, produced in collaboration between mathematics and science specialists. The production of such guidance would ideally follow the development route taken by the Language of Measurement project run by ASE a few years earlier, in which a team of experts produced a document that aimed to clarify terminology used in science investigations.

Funding from the Nuffield Foundation in 2014 allowed the mathematics work to go ahead, with the formation of a steering group that advised on the range and content of a publication aimed at teachers of 11-16 science. During the project, discussions

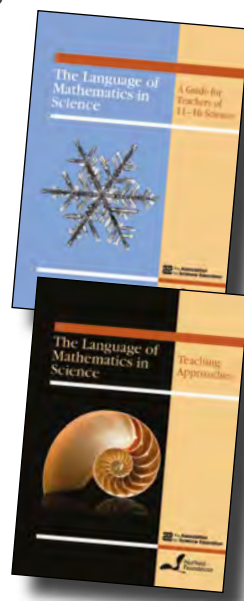
took place with representatives of awarding organisations, who proved to be supportive of the approaches taken in the publication. An important consideration was that the recommendations in the publication should be realistic in practice, so the concluding stage of the process was a review of the draft guidance by a large panel of teachers before the production of the final publication,

The Language of Mathematics in Science: A guide for teachers of science 11-16' in 2016. A further publication, *The Language of Mathematics in Science: Teaching Approaches*², containing a series of case studies detailing the approaches to teaching mathematics in science lessons by some of the teachers involved in the project, was published at the same time.

The aims of The Language of Mathematics in Science project were to:

- Provide an overview of the mathematics relevant to science that may be studied at secondary school;
- Indicate the relevance of the ideas to the activities undertaken in secondary school science;

- Clarify the meaning of the terms used where there are common misunderstandings or where there are different meanings in different contexts;
- Indicate as appropriate where there may be student misconceptions and problems in understanding; and
- Identify, where relevant, approaches taken in mathematics teaching that may influence what is done in science lessons.



Identifying and addressing the challenges

The Language of Mathematics in Science project worked collaboratively with a large number of science teachers through workshops, review panels and case study volunteers. A wide range of issues were identified as contributing to the challenges faced by science students when applying their mathematical skills in science lessons. These included:

- Different terminology used by different teachers to describe a mathematical skill or approach;
- Different approaches used to solve a specific mathematical problem;
- A lack of consistency of approach and language by science teachers within a department;
- A lack of opportunity to discuss coherent approaches between mathematics and science teachers;

^{1,2}<https://www.ase.org.uk/mathsinscience>

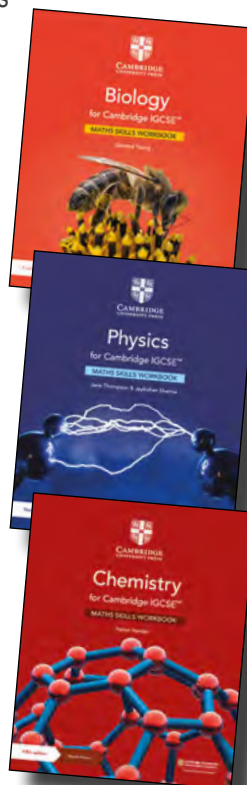
- Timing within the curriculum leading to mathematical skills being introduced in science before students had met these skills in their mathematics lessons;
- Science contexts obscuring the mathematical skills required within a science lesson. (Often students were introduced to complex mathematical ideas within a challenging science context, rather than introducing the mathematical skill in familiar contexts first.); and
- Science teachers not recognising that their use of a mathematical term to describe a skill process or feature may not be consistent with the use of that word in mathematics teaching. Examples include 'line', 'range' and 'histogram'. (The construction and interpretation of graphs was a particular area of concern for science teachers.)

Development of Cambridge IGCSE™ Biology, Chemistry and Physics Maths Skills Workbooks

The Language of Mathematics in Science materials were produced as a reference guide for teachers, rather than students. Teachers were expected to use their professional judgement to decide if, when and how the mathematical skills within the guidance booklet should be introduced and practised in science lessons.

Through a collaboration with ASE, Cambridge University Press has converted ASE's guidance for teachers into workbooks for students, putting the mathematical skills into subject discipline (biology, chemistry and physics) contexts rather than in more general scientific contexts.

The workbook author team are ASE members with significant expertise in GCSE resource development in their individual subject disciplines. The authors followed an agreed template for consistency, but then used their subject expertise to decide how much focus to place on each skill depending on the requirements of different science disciplines. For example, the physics workbook places an emphasis on measurement, units, calculations and working with number, whilst the biology workbook has greater emphasis on graphing. All workbook content was carefully developed for the Cambridge IGCSE™ science syllabuses.



The maths skills workbooks support students by providing authoritative guidance in keeping with the approaches used by awarding bodies on the language, techniques and skills to be used when dealing with different mathematical ideas in scientific contexts. The workbooks also provide an effective route to assessment to help teachers plan and refine their teaching. In addition, they are an effective support for teachers who are not confident at addressing some of the mathematical ideas required by their course specification. The approaches used in the workbooks mirror those advocated in *The Language of Mathematics in Science*, such as introducing standard form, in ways that promote

understanding and avoid recognised misconceptions.

The workbooks adopt a similar sequencing of ideas to that used in *The Language of Mathematics in Science* guidance (data collection; data display; data interpretation; calculations and mathematics in the real world). *The Language of Mathematics in Science* guidance has coherent threads of ideas running through the text, but these ideas are not hierarchical, and imply no specific sequence of teaching. Similarly, the workbooks have a common structure, but the content chapters could be used by students in any appropriate sequence.

The workbooks contain a useful glossary of terms used in the text that appear in bold, covering the more commonly used terminology appearing in *The Language of Mathematics in Science*, as well as some of the terms described in *Language of Measurement*. The definitions used have been adapted to be more age-appropriate to school students.

The mathematical content in each of the workbooks is similar, but the contexts used in each of the disciplines is very different so, as an example, using Chapter 1 to develop measurement skills, the biology workbook could be used as an introduction to the skill, and then this could be reinforced using the physics workbook that looks at the topic in more depth. Co-ordinating the use of these workbooks across the three science disciplines would be of significant benefit to students, enabling them to develop a detailed and confident approach to the use of mathematical skills in science.

Richard Needham is a former Chair of the Association and former Chair of Trustees.

A Limit Less life with physics

Rachel Hartley

The Limit Less campaign, launched by the Institute of Physics, is reaching out to everyone who has an influence on a student's beliefs about what physics is and whether someone like them has a future in physics. We are campaigning for more young people from underrepresented groups to take physics from the age of 16, through changing attitudes and shaping policy decisions. By building a diverse and inclusive physics community, young people can make their own choices about doing physics and enjoying the opportunities that it offers. No one should feel excluded because of stereotypes or someone else's idea about whether physics is for them – physics is for everyone. We need teachers and school leaders to add their voice to the manifesto (<https://campaign.iop.org/manifesto>) to show our elected leaders that there is a demand for change that they cannot ignore.

Last month's exam results underscore the inequity in physics. Not studying physics is going to hit those who would benefit most the hardest. Physics is a living, empowering subject that allows you to be creative, think for yourself

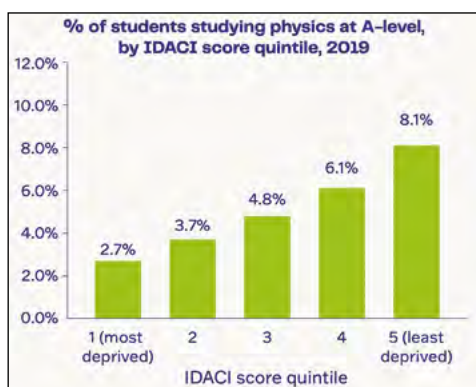


Figure 1. All state schools in England, 2019. Source: Improving Gender Balance and Drayson Foundation Pilot Project Evaluation Report.

and provides a raft of transferable skills that are respected by employers and universities alike.

There is a growing demand for physics skills outside the traditional academic route post-16 through to university. Climate change and the energy crises need a skilled workforce; there are jobs for everyone in physics. Many young people are missing out on rewarding studies and well-paid jobs because of where they're from, what they look like and who they are.

Whether 'girls don't like physics' or 'found the maths too hard' sparked much debate earlier this year, but inequity in physics is not a new problem. The percentage of female students taking physics post-16 has remained at around 23% across most of the UK for several decades. In Northern Ireland, although overall uptake remains low, this year the proportion of female students has increased to 29%. But it's not just girls who are left out of the equation.

Students of Black Caribbean descent had the lowest progression rate to A-level physics in the 2019 reported data for English state schools.

This year's GCSE results in England show that we are far from 'levelling up' and that the gap in student attainment for higher grades has widened, notably between the North-East and London. Coming from a poorer background poses another barrier to studying physics courses required for universities (see Figure 1).

Disabled young people and LGBT+ young people are also less likely to study physics or else face an unwelcoming environment. But we can influence those whose opinions matter most to young people...

Over 2,000 parents and carers were involved in a recent study that examined



factors affecting the likelihood of taking A-level physics. Hamer and Jones (2022) found that **having a parent or carer who agreed that 'physics is useful for getting a good job' was the most significant factor affecting subject choice** and that this had double the effect on the 10-point likelihood scale as 'being a boy'.

Involving parents and carers from the start can help children and young people to challenge inequality in wider life. Taking a whole-school community approach, including having regular conversations about careers and jobs from physics can help to challenge the stereotypes and societal expectations about who does physics. The IOP has created a new suite of resources for 12-15 year-olds and their families, along with lesson plans and PowerPoints for teachers.

The start of the school year is an excellent time to start conversations about where physics can take you and to join other schools who have signed our manifesto.

References and resources

Limit Less resources for 12-15-year-olds and their families, teachers and volunteers
www.iop.org/careers-physics/careers-resources

Teaching without limits: nurseries, schools and whole school equity plans
www.iop.org/strategy/limit-less/nurseries-schools

Improving Gender Balance and Drayson Foundation Pilot, Project Evaluation Report, <https://tinyurl.com/IOPdata2020>

Jones, K. & Hamer, J. (2022) 'Examining the relationship between parent/carers' attitudes, beliefs and their child's future participation in physics', *International Journal of Science Education*. 10.1080/09500693.2021.2021457

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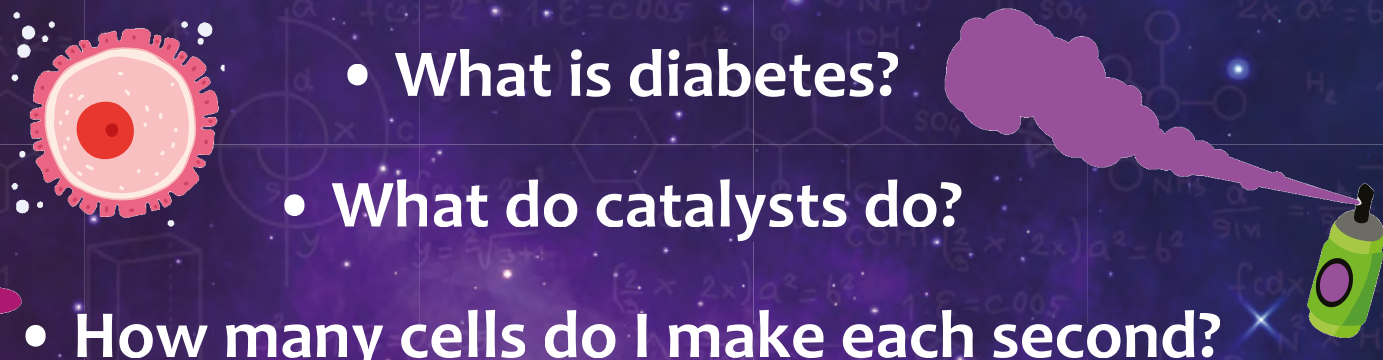


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