

# Secondary

STEM Learning Magazine • Edition 15



World-class CPD, inspiration and resources from STEM Learning



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Narrowing  
the gap

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STEM Ambassadors:  
healthcare  
superheroes!

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a place to grow



# Welcome to the 2021 edition of your STEM Learning magazine

It's been a really challenging year for all involved in education. Your response has been magnificent. In this edition, we review some of the ways you've adapted, improvised and overcome - and their implications for STEM education.

Continuing to provide high standards in education has led more of you to access CPD and resources to develop subject knowledge and skills, introducing greater innovation in remote teaching. What you have learned will have lasting impact in the classroom and offers foundations for the next generation of best practice approaches.

The impact of the pandemic will require us all to redouble our efforts to close the attainment gap and support young people growing up with disadvantage. We cover this important topic and highlight the role of STEM Ambassadors as relatable role models who raise aspiration, support learning and illuminate careers.

We've seen great examples of schools and colleges reaching out to share resources and expertise with each other. We hope that this collaborative approach can develop further. Similarly, our new STEM Community has brought teachers and technicians across the UK closer. It's a place to innovate, ask, be inspired and connect. Find out more inside.

As ever, we reach across the breadth of STEM subjects. We also showcase the work of the National Centre for Computing Education, which we're proud to be part of, and which ensures that every young person can benefit from a high-quality computing education.



As we look ahead, know that STEM Learning remains firmly by your side to offer high-quality solutions to your pressing and emerging needs, and to give you the tools, resources and confidence to deliver excellent STEM education. Here's to brighter times.

*Mark*



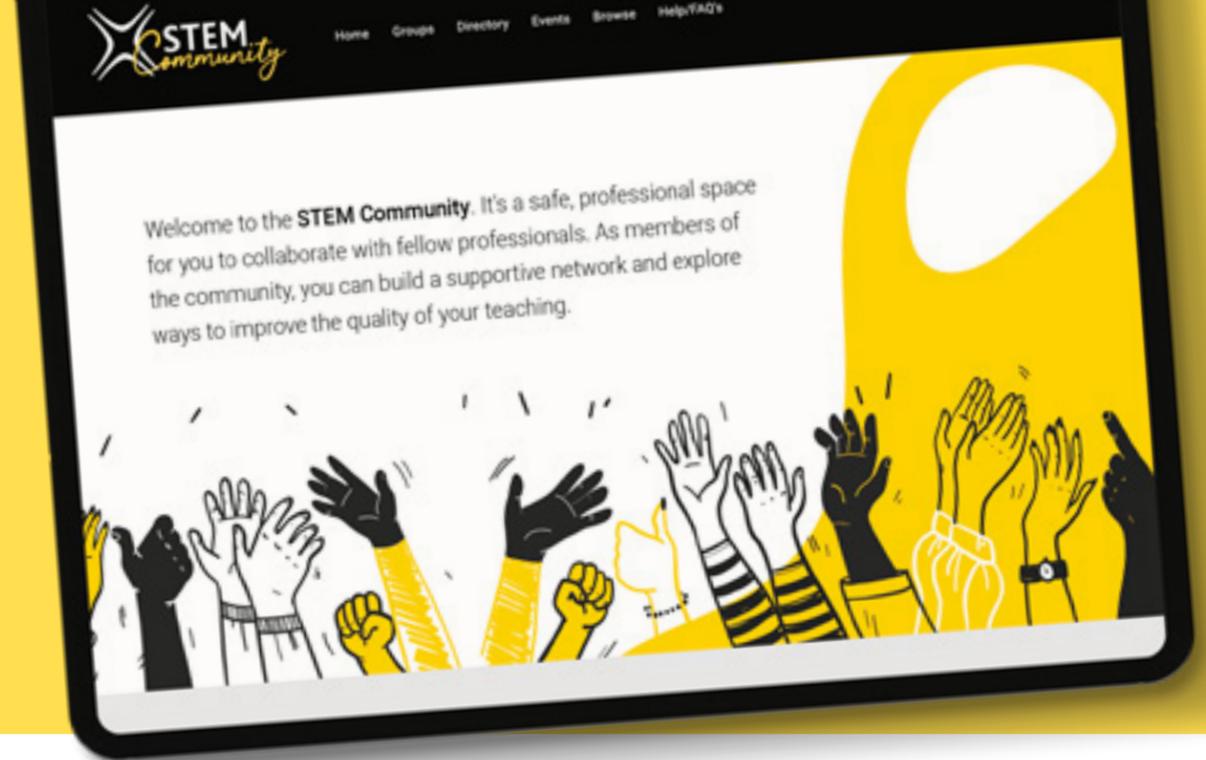
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A digital version of this magazine is available on our website: [www.stem.org.uk/mag15s-digital](http://www.stem.org.uk/mag15s-digital)

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# At the heart of education lies collaboration



In an effort to improve educational outcomes and help students to perform well, teachers have spent the vast majority of our time looking after our own networks and the children within our own schools. That is not to say that many of us don't swap ideas, network or share best practice. We do, but we can do more across education as a whole.

It is almost inevitable that schools and institutions have, in the past, held their improvements and innovations within their own communities. So when we look back on education before the COVID-19 pandemic, we should do so with our eyes open because we were operating in a flawed system that was inherently doing its best. Collaboration is our future.

Amongst many of us in education, a growing realisation that we need to consider the wider needs of our society began to form a grassroots movement across the country. Something fundamental began to change. Schools, staff, teachers and leaders up and down the country began to share in a way like never before and with one core principle at the heart of the sharing: helping others.

It sounds like a small and obvious thing – sharing to help others – but, if we think

about it carefully and indeed honestly, it is quite a change. Education for many of us has always been about doing the best we can do for children. We have now woken up to what is possible and, indeed, what is needed from us all. It is no longer enough to help the children and families within our own schools. That is a basic expectation and a given.

The emphasis now is on helping all children – those within our own



**“We have now woken up to what is possible and, indeed, what is needed from us all. It is no longer enough to help the children and families within our own schools.”**

schools and those across the country. Recently, we have seen amazing examples from schools, local authorities and multi-academy trusts up and down the country sharing amazing teaching resources to help vulnerable children on a large scale.

Education has taken the first step and now we need to take the next one to ensure that we are not held back by the limits we place upon ourselves.

There are often barriers that schools, teachers and leaders put in their own way which prevents them from sharing key learning and what they have built or created. Nervousness in education before COVID-19 meant that amazing and innovative concepts and resources often sat with a school internally, because there was a genuine fear that putting them out into the wider world would do one of two things:

**1** it might shine a spotlight on the school and often the majority of schools prefer to stay out of the limelight

**2** it may lead to the school questioning whether the knowledge is worthy of being shared, that this sharing might even lead to criticism

These two elements have often proven to be the barrier to the systematic sharing of ideas. Education needs to move past this and learn the art of helping others. Sharing thinking, sharing concepts, sharing resources is about saying to the educational community that you've done some work and thinking on a key concept and you are happy to put it out there for others to build on – a foundation and a starting point. What we share isn't, and shouldn't be, perfect – in fact, you can argue that things shared should be in their raw form so that others can see how they have been devised and the thought processes that have gone into them.

At the heart of education lies collaboration and so our next meaningful step is to make sure that we build on the true altruism shown through this period and take on the baton to push things further. Let's move past random sharing of great thinking and resources to

systematic sharing of resources and thinking across the educational community.

Let's all work by the premise that anything shared at a point in time is there to be built upon. If we operate by the mantra that we seek to build on each other's work, and take it as a given that we expect others to refine and improve what we have done, then education will enter a new frontier where schools who have so much to offer, but have been nervous in the past, begin to value what they have created and share with others. It will also see local authorities and multi-academy trusts across the country build collaboratively new and innovative ways of working.

Education is evolving into a true, unified community that operates nationwide. We all have a part to play. Let's accelerate the progress and push harder and faster in the right direction – making a positive impact.

## RHM LEARNING PROJECTS

■ [www.robinhoodmat.co.uk/learning-projects/](http://www.robinhoodmat.co.uk/learning-projects/)

# Narrowing the gap

There has never been a more important time to focus our attention on narrowing the gap for disadvantaged students and particularly those who are persistently disadvantaged. Despite the attainment gap narrowing over the last 20 years in England, the gap between disadvantaged students and their more privileged peers remains stark.

The Education Policy Institute annual report (2020) found that the attainment gap between disadvantaged students and their peers has stopped closing for the first time in a decade. This was before the pandemic hit and restricted our educational establishments, meaning children were not being provided with education in the more traditional sense.

Many schools have done a fantastic job of providing both synchronous and asynchronous learning at home. However, this simply compounds the issue for disadvantaged students, as they remain the most likely not to access it, either by choice or otherwise. Inevitably, this is widening the gap further, with analysis by the Education Endowment Foundation (EEF) charity finding “the closure of schools to most students is likely to reverse all progress made to close the gap since 2011”.

The EEF analysis median estimate is that the attainment gap could widen by 36% but it could be anything between 11% and 75%.

This is scary reading – schools need to accelerate their support for students living with most disadvantage, maximising the use of pupil premium, to ensure the focus is pointed towards the strategies and resources that have evidence of working.



There is a long list of contributing factors to the narrowing and widening of the attainment gap, from quality early years teaching to the home learning environment and parental support. Other factors include: experience of school, transition between schools, schools’ Ofsted status, class grouping by attainment, careers and work experience, to name a few.

Schools should be aware of these factors and support persistently disadvantaged students by promoting effective strategies that are known to work. The report *Supporting the attainment of disadvantaged students: articulating success and good practice research* (Department for Education (DfE), 2015) investigated the role of school strategies and approaches in raising disadvantaged students’ attainment.

**One of the key findings showed schools using fewer but effective strategies had more success.**

The report *Cracking the code: how schools can improve social mobility* (DfE, 2014) goes further and states that effective use of pupil premium is only one piece of the jigsaw and outlines the importance of:

- building high expectations and an inclusive culture
- an incessant focus on quality early years teaching
- tailored strategies to engage parents
- preparing students for all aspects of life, not just exams

The teaching strategies deemed by schools to be most effective in increasing disadvantaged students’ attainment include:

- paired or small group additional teaching
- improving feedback to students
- one-to-one tuition
- provision of additional teachers or teaching

All these strategies were supported by the evidence of effectiveness in the Sutton Trust/Education Endowment Foundation (EEF) Teaching and Learning Toolkit. The toolkit also suggests the following interventions have the greatest impact on young people’s academic progress and are specifically beneficial for improving the educational outcomes for disadvantaged students. Each delivers an average of 5+ additional months’ progress in attainment:

- **early years interventions** – early years and pre-school interventions have a positive impact and appear to be particularly beneficial for children from low income families
- **one-to-one tuition** – the evidence is consistent and strong, particularly for disadvantaged students
- **oral language interventions** – reading aloud and book discussion with young children, extending students’ spoken vocabulary, using structured questioning to develop reading comprehension

To make progress in raising attainment for disadvantaged students, schools should focus on effective leadership, ensuring high-quality teaching and encouraging parental involvement in the school community.

Recognising the importance of early years provision and effective transition between schools, plus fostering an ethos of high expectations for all young people are all proven methods in narrowing the gap and making sure that disadvantaged students get the same chances as their peers.

These strategies are certainly at the forefront of our minds at STEM Learning. To find out more, check out our Narrowing the attainment gap web page.

■ [www.stem.org.uk/narrowing-the-gap](https://www.stem.org.uk/narrowing-the-gap)

## EEF TEACHER TOOLKIT

■ <https://educationendowmentfoundation.org.uk/evidence-summaries/teaching-learning-toolkit/>

## CRACKING THE CODE: HOW SCHOOLS CAN IMPROVE SOCIAL MOBILITY

■ [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/360753/Cracking\\_the\\_code\\_Final.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/360753/Cracking_the_code_Final.pdf)

The DfE study identified seven building blocks for this success:

- 1 Promote an **ethos of attainment for all**, rather than stereotyping disadvantaged students
- 2 Treat students on a **case-by-case basis**, addressing their barriers to learning and give them emotional support, as early as possible
- 3 Focus on **high-quality teaching first**, rather than on bolt-on strategies and activities outside school hours
- 4 Focus on **outcomes for individual students**, rather than providing different strategies
- 5 Deploy the **best staff to support disadvantaged students**; develop the skills of teachers and teaching assistants
- 6 Make **decisions based on data** and respond to evidence, using frequent assessment
- 7 Have **clear, responsive leadership**: set high aspirations and give all staff responsibility for raising attainment

## FURTHER READING

### THE EDUCATION POLICY INSTITUTE ANNUAL REPORT 2020

■ <https://epi.org.uk/publications-and-research/education-in-england-annual-report-2020>



# Maximising the classroom impact of continuing professional development

Professional development can be nice – nice food, nice company, nice surroundings and a nice break from the day-to-day teaching routine – but the benefits to students may not always be so obvious.

By feeding your passion for your role through continuing professional development (CPD), you are keeping up-to-date with changes that affect curriculum, teaching and learning, leadership, and developing new and improved practices – all methods that benefit your students.

CPD also provides time and space to reflect on the needs of your students and how best to meet them, with expert guidance, collaboration and professional dialogue with peers.

Participation in CPD is an investment of time, effort and sometimes money, and it is in everyone's interest that it generates maximum impact – principally in the classroom.



## SO, WHAT IS 'IMPACT'?

Impact mainly relates to improving student outcomes, and understanding the conditions in which this occurs. While attainment is of massive importance, there are a multitude of student outcomes that can be improved through implementing new practices, for example:

- improved attitudes towards learning might be demonstrated through greater engagement in lessons, or opting to follow subjects when the choice is offered. This can, in the long term, translate to changed career aspirations and motivation to succeed
- students may develop transferable skills, deeper understanding or flexible knowledge, where the impact is more widely felt over the medium to long term
- students may change their behaviours by improving the quality of discussion, acting in safer or more efficient ways, or other observable actions
- learners' beliefs may be affected, be that greater belief in themselves, in their teachers or the place of a subject in the wider world. If students see a subject as important, and can see themselves remaining connected to it, then they are more motivated to engage with it, displaying curiosity, optimism and other positive traits that lift the whole room

Curriculum change, improved subject leadership, subject knowledge enhancement... these are deeper undertakings that remain focused on improved student outcomes in the long term.

The most immediate impact of CPD is on the participants themselves, with the ripples extending outwards to their colleagues, students and the wider school community. We work hard to develop relevant and impactful CPD content, then to support participants to identify their pressing needs and take away the most relevant solutions. But it's not really about us...

## CREATING THE RIGHT CONDITIONS FOR IMPACTFUL CPD

When teachers apply new approaches in the classroom, it's vital that these are based on evidence. What works is important, but what sometimes remains unsaid is that educational research is carried out in a specific environment, and should be considered with a critical eye. Impactful CPD must help teachers to establish what works for them based on their experience, subject knowledge and the context of the school or trust in which they teach.

The facilitators of great CPD are trained to expertly challenge assumptions, misconceptions and myths in ways that aren't always comfortable, but that are necessary for real progress to be made. They also assist teachers to develop their own action plans, with defined outcomes and timescales – the simple things that, if not done properly, can result in professional learning sitting in a folder, untouched and forgotten.

Knowing what works in one's own context is a skill in itself. Teachers are immersed in the teaching environment and it can be hard to get an accurate view of the success, or otherwise, of a teaching practice from within. Our facilitators and complementary video guidance, developed in collaboration with the Institute for Effective Education, guide participants through the process, helping them to focus and to make informed, communicable evaluations.

## SUPPORT FOR PROFESSIONAL DEVELOPMENT

There are quick and simple changes in the classroom that can have an immediate effect, but significant improvement requires a more substantial commitment to professional development over a sustained period of time.

Our school system is a lean machine, with little spare capacity, so it's important that CPD is provided in a variety of ways that make participation possible. Teachers may need to negotiate for the opportunity to participate in CPD, so it is vital that the outcomes are clear, relevant and timely. We aim to support – through the unique Impact Toolkit – a conversation with other stakeholders to ensure the aims of CPD align to school priorities and the benefits are experienced beyond the individual teacher.

This process extends well beyond the CPD session itself. Of course, developing a clear view of the effectiveness of implementing CPD, and sharing this with decision makers, creates a virtuous circle where CPD is prioritised, resulting in further improvement. The most successful schools take this cycle and the strategic planning of CPD seriously, resulting in better teacher retention and improved student outcomes.

We hope that it's not just us telling school leaders about the importance of CPD but that, by raising expectations of quality and impact, it is self-evident.

## FIND OUT MORE:

Develop your ability to evaluate the effectiveness of new teaching approaches across secondary:

- [www.stem.org.uk/mag15s-evaluating-new-teaching-practices-computing](http://www.stem.org.uk/mag15s-evaluating-new-teaching-practices-computing)
- [www.stem.org.uk/mag15s-evaluating-new-teaching-practices-design-and-technology](http://www.stem.org.uk/mag15s-evaluating-new-teaching-practices-design-and-technology)
- [www.stem.org.uk/mag15s-evaluating-new-teaching-practices-maths](http://www.stem.org.uk/mag15s-evaluating-new-teaching-practices-maths)
- [www.stem.org.uk/mag15s-evaluating-new-teaching-practices-science](http://www.stem.org.uk/mag15s-evaluating-new-teaching-practices-science)

Teachers, especially those in computing, can benefit from this free online course on improving classroom practice through action research:

- <http://ncce.io/mag15s-course30>

# Exploring science pedagogy using scientific method

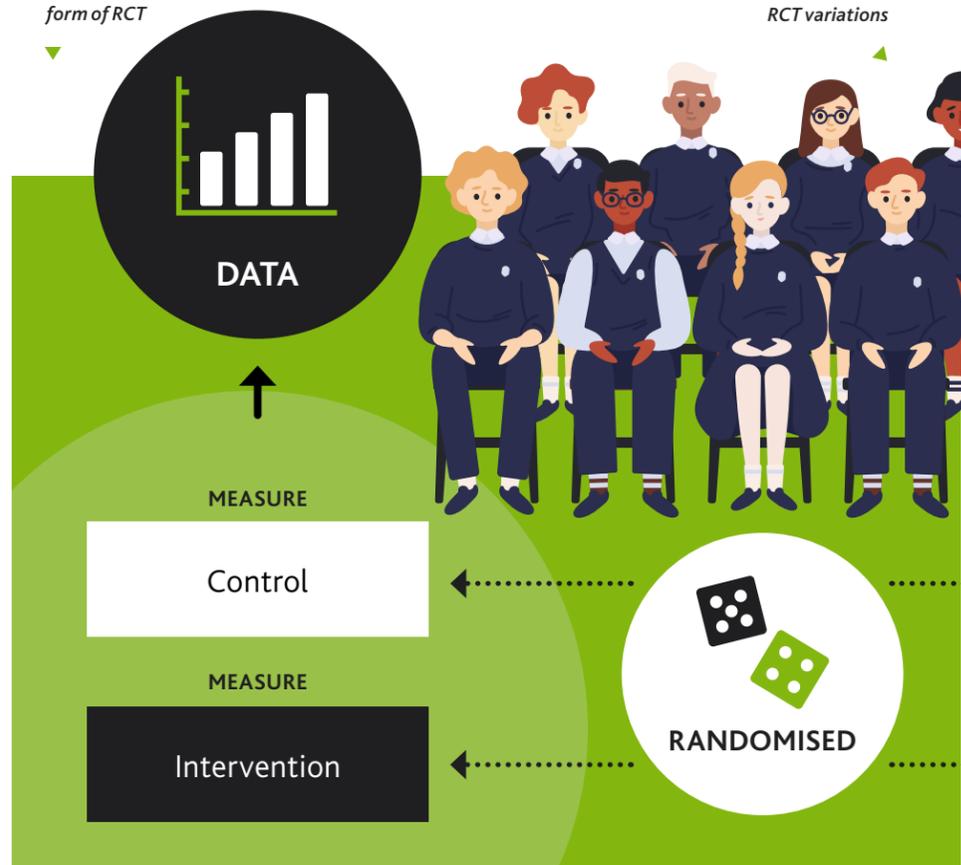
In medicine and healthcare, serving doctors conduct much of the clinical research – helping to take treatments from 'laboratory bench to bedside'. In contrast to this, there is a significant shortfall in practising teachers' designed education research.



The Education Development Trust (a global education charity) has been exploring how to change this. As a result, hundreds of teachers around the world have conducted 'clinical' trials paralleling those by doctors and surgeons. From Global Teacher Prize nominees to collaborations with neuroscientists (funded by Wellcome) and a Department for Education project exploring workload reduction, we have looked at how teachers can design randomised controlled trials (RCTs) – combining results in big data analyses to help understand what works, with which children and in what context.

RCTs are the 'gold standard' research approach in many sciences. They have a control group (or condition) that an intervention is compared to. In education, the control will usually be existing best practice – as with surgery, where you might compare a new operation to a current one. Treating patients would need to continue regardless, as does teaching in the classroom. We use randomisation to allocate participants to the conditions. This helps to remove researcher bias. Finally, there needs to be some form of relevant measurement that the conditions are tested (or 'tried') against.

**Fig 1.**  
The most common form of RCT



**Fig 2.**  
One of many possible RCT variations

Most importantly, the programmes combine the teachers' results into a 'meta-analysis' in which the different effects across the studies can be compared.

Working with the Education Development Trust, STEM Learning has been awarded a further Wellcome grant to explore science pedagogy using teacher-led RCTs. Earlier this year, we launched training for the first two cohorts of teachers. The remote and blended learning programme combines video content, reading material, online live learning sessions and one-to-one mentoring opportunities with Kate Sims

and Emma Gibbs, education consultants at the Education Development Trust.

There is funding for 60 places on the programme. Once these first cohorts have completed an initial trial (spring term 2021), they will go on to act as a research lead, training and supporting groups of other serving teachers to conduct replications. By the end of the year, we hope to be able to report on several hundred trial results.

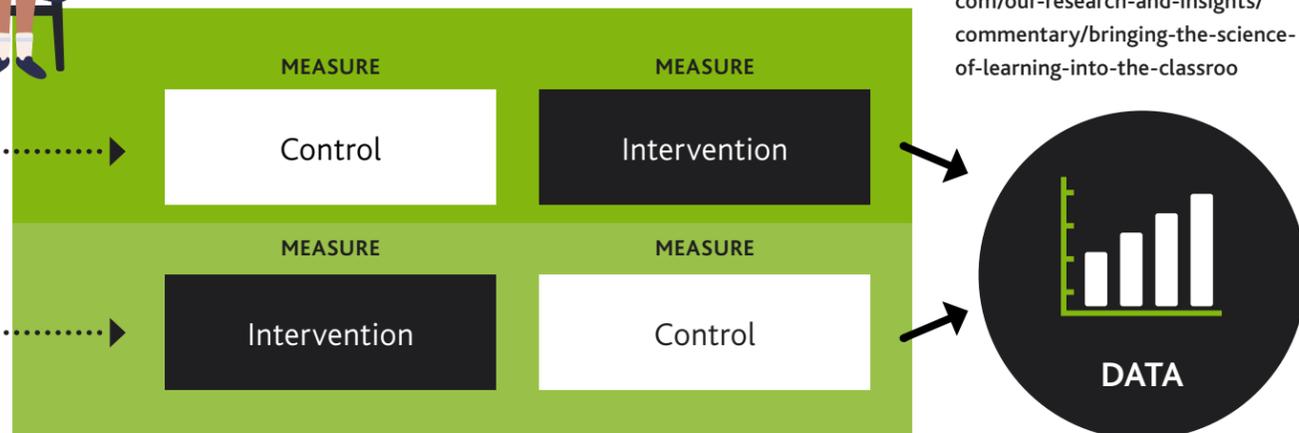
Fran Dainty, Head of Education at STEM Learning, commented: "We are delighted to be able to collaborate with the Education Development Trust to further support the teachers we work

with to implement new strategies, ideas and pedagogies into their teaching.

"This project will provide us all with a deeper level of understanding of what reaps the greatest impacts for young people, in the contexts of their own classrooms and schools. This is a great opportunity for teachers to contribute to the scientific and educational evidence base, that can only improve the impact of what we all achieve in the future for all young people".

## TEACHER-LED RESEARCH AND NEUROSCIENCE FOR TEACHERS

www.educationdevelopmenttrust.com/our-research-and-insights/commentary/bringing-the-science-of-learning-into-the-classroom



# STEM Ambassadors: healthcare superheroes!



Many students will remember when they celebrated healthcare professionals by clapping on Thursday evenings. Some students may have even been inspired by the events of 2020 to wonder if they could do a job in healthcare when they are older.

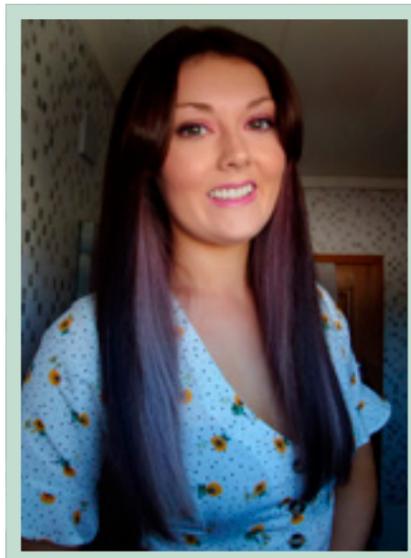
From bioscience lecturers to engineers and therapeutic radiographers, in this article, we shine a light on some of the fantastic STEM Ambassadors who work in the healthcare jobs your students might not have heard of yet!

## CHLOÉ YOUNG, Registered Dietitian, self employed

I am a self-employed dietitian with a degree in nutrition and dietetics. Many dietitians work across the NHS, in private practice, food industry and in media. I have always had an interest in food and love being able to apply the science of nutrition to help people.

I use biology and chemistry in my job to understand how the human body works in health and disease, and what happens to nutrients in the body. Dietitians apply science to treat or prevent illness using food as treatment – as a dietitian, I use research and convert complex science into easier-to-understand information for my clients and the public.

Dietitians use evidence-based information in all the work they do, so an understanding of science is essential. When supporting people, it is important that I help them to understand what is happening in their body, and how changing their diet or additional nutrition support will benefit them. Our understanding of nutrition and evidence is an exciting and constantly developing area, so it is very important to keep up to date with scientific research.



I became a STEM Ambassador to share my passion for science and my fun profession, one that relates to food and caring for people. Dietetics is a small profession promoting appropriately-qualified nutrition professionals and evidence-based nutrition. Many nutrition 'professionals' or 'therapists' are not necessarily degree qualified and do not always use research-backed science in their jobs, unlike dietitians.

## VICTORIA HEATH, Deputy Trust Lead Healthcare Scientist at the NHS @micheath

I work in the NHS as a healthcare scientist. Healthcare scientists use STEM subjects to help diagnose and treat patients. There are over 50 specialties in healthcare science, and – because I have never been able to make a decision – I specialised in both virology and immunology. In virology, I test patient samples to see what virus is making them sick. In immunology, I look to see if patients have conditions where their immune system is not working properly or if their immune system is attacking their own body.

I signed up as a STEM Ambassador because I wanted to share the work of healthcare scientists in the NHS with everyone! I've been really fortunate with the opportunities I've had in outreach. I have helped write a play about scientists called *Remember Remember*, which is now freely available on YouTube, and developed activity packs for children in the hospital to complete.

I've hosted a comedy show, where I got to mix my role as a scientist with my evening job as a stand-up comic. I think this is really important to demonstrate how flexible a career in science can be.

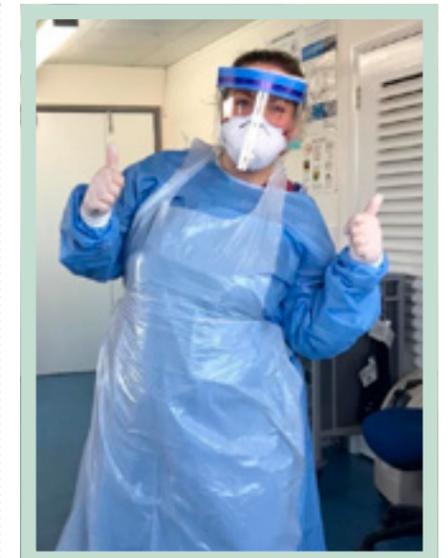
## KIMBERLEY LEWIS, Specialised Respiratory Physiologist at Powys Teaching Health Board

I study anatomy and physiology of the lungs. Every day, I use a broad selection of science skills, including physics, chemistry, biology and mathematics. The physics part of my job enables me to determine how gases behave. Chemistry is important – as part of the testing of patients' carbon monoxide and helium levels.

Most physiologists work in hospitals, but some work with professional athletes and sport teams, others in study teams – and in some extreme climates. Everest base camp is a particular favourite!

### Classroom activities I've been involved in include:

- additives – students had to identify where a range of chemicals are used together and we explored why they were added to the product, the product being cigarettes
- long-term smoking damage - using cotton wool balls in a 'smoking' bottle to demonstrate the increased deposition of tar in the lungs
- what do the lungs look like? Cattle lungs (with heart) were dissected in the classroom to explore what the lungs look like



- who has the biggest lungs? Investigating the relationship between height and lung size
- investigations involving the human body – exploring how to investigate how the human body moves and how it relates to other physical features, such as height

CONTINUED...

# STEM Ambassadors: healthcare superheroes!

**ROBERT WRIGHT**, Graduate Research and Development Engineer at DePuy Synthes

I design and test instruments and implants for hip and knee surgeries. My work helps to make sure that the equipment used in operations is the best it can be, and that the prostheses we create will give the patient the best chance of recovery and an active life.

I apply the science of friction, wear and lubrication (tribology) to test how our prostheses are likely to perform in the body. Knee and hip simulators replicate the motion of an anatomical joint during walking for millions of cycles over the course of a few weeks. I weigh the components at specific increments on high-precision scales to determine how much material has been worn away.

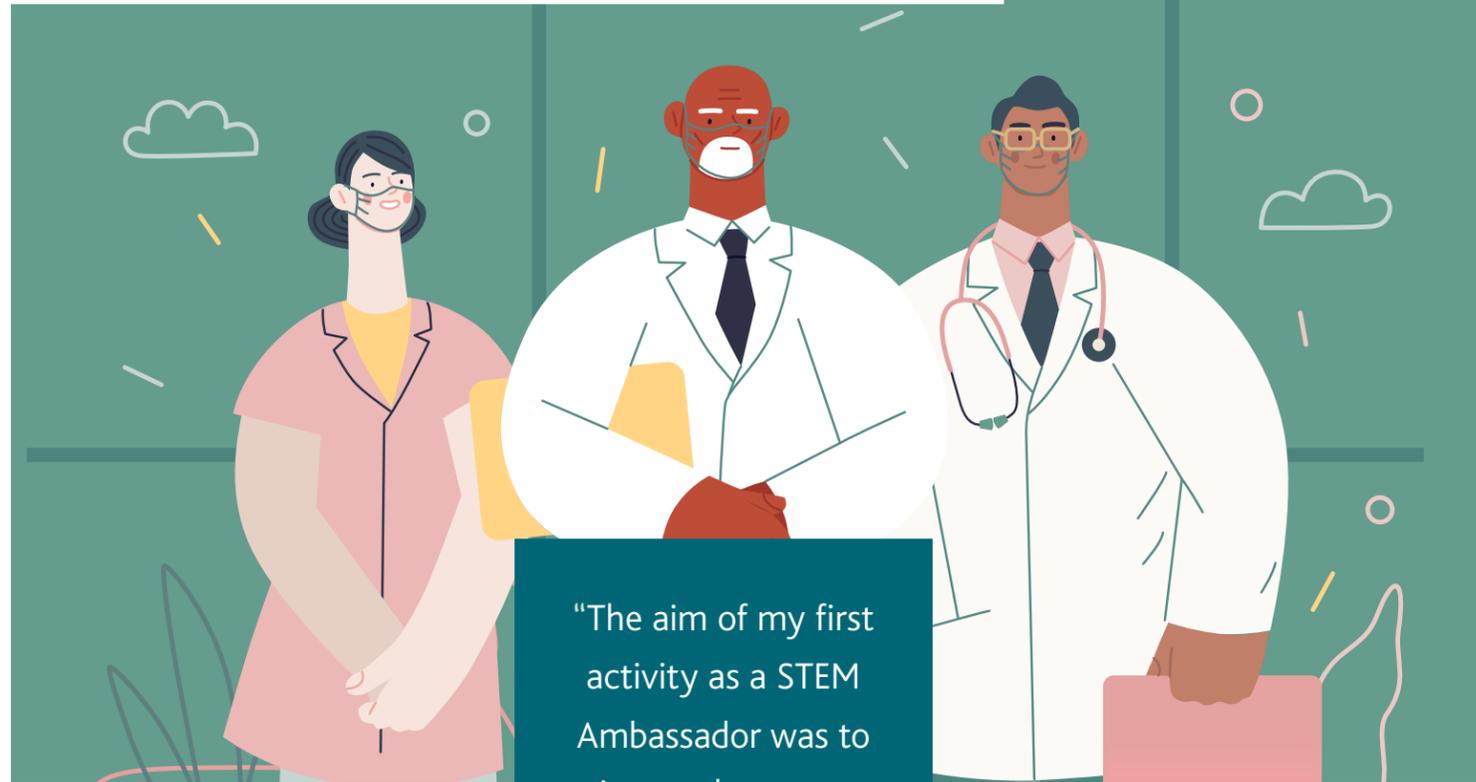


I use engineering principles to determine the durability of surgical instruments and implants, with large hydraulic machines applying compressive, tensile and torsional loads; testing the resistance of samples

in relation to deformation and fracture. I use a machine called an impaction rig to strike samples repeatedly, mimicking the impact of a surgeon's mallet on a surgical instrument.

My first activity as a STEM Ambassador was to present on the topic of 'Victorians and STEM', looking at how modern medical devices have been influenced by innovation in the Victorian era. The aim of the event was to give teachers more ideas for integrating STEM topics into their history lessons.

STEM Ambassadors help to educate young people on the broad variety of engineering careers out there. These experiences are pertinent to addressing the gender disparity in the engineering workforce, making engineering more accessible and appealing to a more diverse population of students.



"The aim of my first activity as a STEM Ambassador was to give teachers more ideas for integrating STEM topics into their history lessons."

- Robert Wright

**DR EMMA YHNELL**, Lecturer in Biosciences at Cardiff University, School of Biosciences @EmmaYhnell

I teach the next generation of budding scientists. I have conducted scientific research in the laboratory and patient clinics into the genetic brain condition Huntington's disease. I take every opportunity to bring science to a range of audiences through my science communication and outreach work.

I have given prestigious public talks at TEDx, the British Science Festival and the Hay Festival to increase awareness of science as a career option and to talk about my research.

I take special interest in neurodegenerative diseases, such as Huntington's disease, Parkinson's disease and Alzheimer's disease. I like to keep my talks engaging and interactive – whether that is playing live brain-training games with the audience, running through genetics with the help of a washing line of

jeans or demonstrating the process of neurotransmission using a bubble gun – you'll never be bored in one of my talks!

I have delivered workshops on the brain, including sessions on DIY brain surgery where students are tasked with removing poorly bits of brain using scan results. I have worked with patients and families impacted by Huntington's disease and I give public talks to advocate for families and improve awareness and understanding of the disease. As a first-generation academic and a woman in science, I want to inspire others to see that science can be for everyone.

**BRIDGET AKANDE**, Clinical Scientist (Audiology)/Senior Specialist Audiological Scientist at Guy's and St Thomas' NHS Trust

Audiology is a branch of science that studies hearing, balance and related disorders. I help people who struggle to hear. I do this by testing their hearing and fitting them with hearing aids or other devices to help them hear better.

My role involves taking clinical histories, fitting hearing aids and cochlear implants, testing patients' hearing and conducting different audiological tests. This enables me to check a patient's ears, see what type of hearing loss they have, what benefit they are getting from their hearing device and how I can help them manage their hearing concerns.

As a STEM Ambassador, I've participated in careers fairs and STEM Careers talks to inspire students and make them aware of this niche career in healthcare science. Hearing sound is a sense that is crucial for communication. Deterioration in this sense affects people's lives and my role is great, as it merges caring for people with science.

**NAMAN JULKA-ANDERSON**, Senior Macmillan Therapeutic Radiographer and **SHANNON JOHNSON**, Rotational Therapeutic Radiographer at Musgrove Park Hospital @naman\_julka • @shannolivia97

As therapeutic radiographers, we are able to treat a wide variety of different cancers using particles such as electrons and photons.

Facing a 33% decrease in students studying radiotherapy across the country, we wanted to improve awareness of careers in radiotherapy in our area, Somerset. We actively sought out the STEM Ambassadors programme and reached out to schools offering sessions for teachers, career events or talks, as well as work experience - all with great success.

We created a programme of work experience and enrichment days for students. These proved so popular that we had twice as many applications as there were places to fill.

Radiotherapy is an incredibly specialised career, meaning that not many people will know about the job role of a therapeutic

radiographer unless they have experience of radiotherapy through personal circumstances. Currently, radiotherapy is used to treat 50% of all cancer patients. We are trying to spread the word of how vital and underrated this cancer treatment is.

Due to the pandemic, we have had to adapt our roles and way of teaching and learning through virtual careers events and work experience. We have been able to reach a much wider audience of different age ranges, enabling us to continue to promote the profession of radiotherapy and inspire prospective students.

STEM Ambassadors are continuing to offer online activities to schools and community groups. These can be live and interactive, often taking place via a video call.

They are a fantastic way to inspire your students, get them excited about STEM subjects and give them an insight into how knowledge is taken out of the classroom and into the world of work.

If you're not sure how STEM Ambassadors can support you and your school or you just need some inspiration - speak to your local STEM Ambassador hub:

■ [www.stem.org.uk/mag15s-local-stem-ambassador-hubs](http://www.stem.org.uk/mag15s-local-stem-ambassador-hubs)

Invite a STEM Ambassador to support your teaching, whether that's in a classroom setting or via an online lesson:

■ [www.stem.org.uk/mag15s-stem-ambassadors-supporting-schools-and-colleges](http://www.stem.org.uk/mag15s-stem-ambassadors-supporting-schools-and-colleges)

## RESOURCES

- [www.stem.org.uk/mag15s-medical-physics-resources](http://www.stem.org.uk/mag15s-medical-physics-resources)
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- [www.stem.org.uk/mag15s-range-of-human-hearing](http://www.stem.org.uk/mag15s-range-of-human-hearing)
- [www.stem.org.uk/mag15s-real-life-maths](http://www.stem.org.uk/mag15s-real-life-maths)

## CAREERS RESOURCES

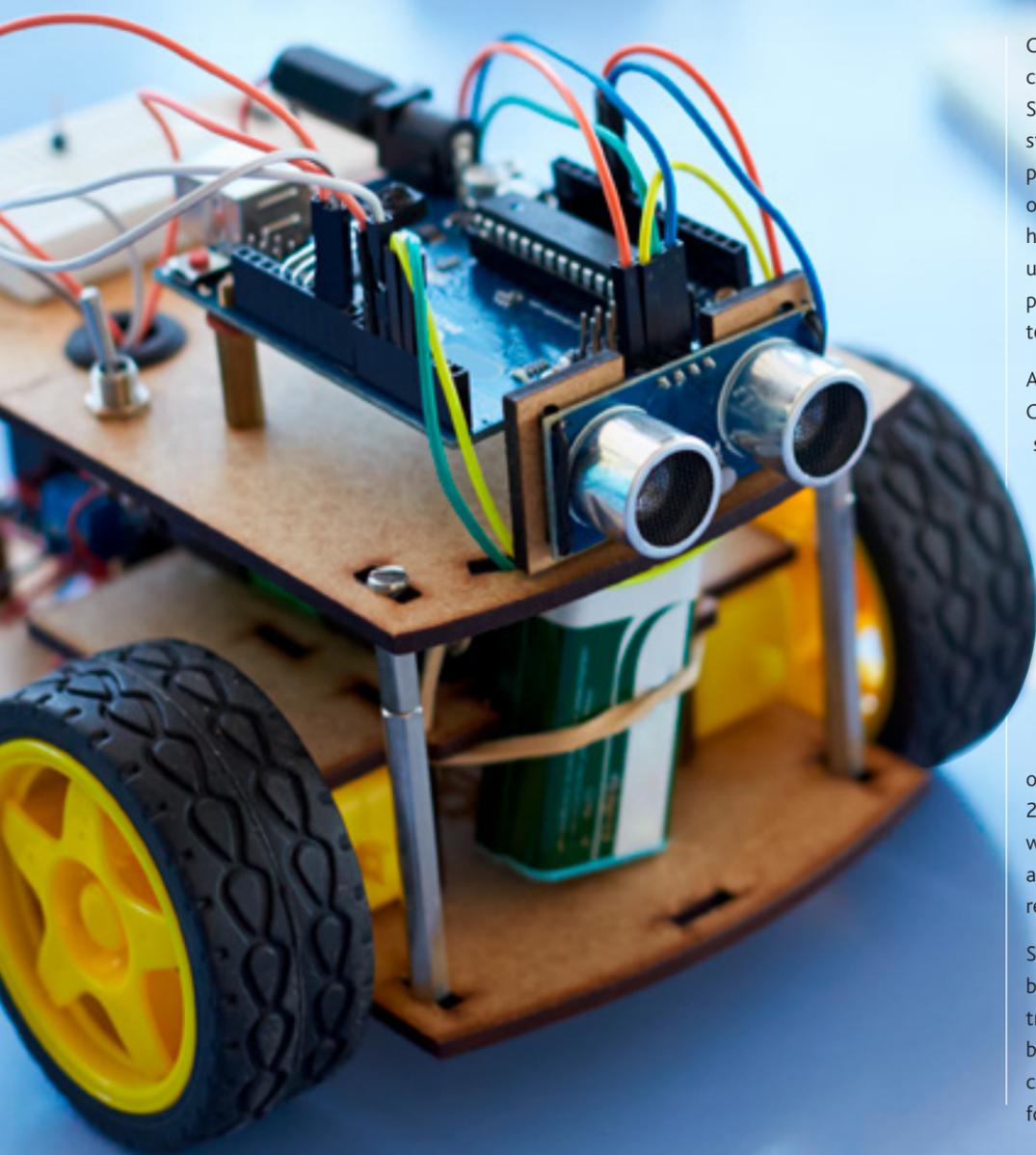
STEM resources

■ [www.stem.org.uk/mag15s-careers](http://www.stem.org.uk/mag15s-careers)

Teachers guide

■ [www.stem.org.uk/mag15s-developing-career-learning-stem](http://www.stem.org.uk/mag15s-developing-career-learning-stem)

# GCSE Computer Science – getting it right in key stage 3



Can that first Year 7 computing lesson really cause a barrier to delivering GCSE Computer Science? For a number of reasons, yes: students lose interest early if they are not progressing by going back over 'old content', or alternatively lessons may be pitched too high, with students being left behind. Poor uptake is the inevitable consequence and poor uptake means no GCSE. Schools and teachers need to get it right from the start.

As a Subject Matter Expert for the National Centre for Computing Education (NCCE), supporting schools who currently do not offer GCSE Computer Science, this has certainly been a common barrier I've identified, one of many. But there needn't be barriers – there are solutions to these challenges.

The Department for Education has invested £84m to upskill computer science teachers and drive up participation in the subject. The number of students studying the subject rose in 2019, and although the reading is still stark, with over 400 mainstream schools opting against computer science, there are definitely reasons which should make us optimistic.

So back to the point above, how do we break down that particular barrier? Firstly transition; arranging half-termly meetings between local primary schools and secondary computing leads could be mutually beneficial for both phases and something a Subject



"Welcome Year 7 to your first computing lesson, log on with your new logins and we will make a start". Computing teachers know all too well that first lessons incur delays; some students may never have used a mouse before and are only familiar with a tablet, or you may have a handful of students who have had little or no computing lessons previously.

So that 'Get to know me' algorithm you expected your students to write in the first lesson didn't quite go to plan.

Matter Expert or your local CAS community of practice can help organise, either face to face or through remote platforms. This, together with having a full and engaging Key Stage (KS) 1-4 (age 5-16) curriculum, will mitigate against students turning off from computing and support a smooth transition between KS2 (age 7-11) and KS3 (age 11-14) to ensure rapid progression and continued engagement.

To help re-engage students in KS3, enrichment opportunities in the form of Code Clubs or Robotics Clubs, highlighting role models, organising trips, inviting guest speakers to discuss the benefits and employment opportunities with computing, all work together to raise the profile and excitement around this wonderful subject. Informal learning in computer science is also important to retain students' engagement in the subject. A break from traditional teaching behind a computer screen will give students an opportunity to see where the technology they use comes from and inspire them.

Building on an engaging curriculum, there is a need for a robust and manageable formative and summative assessment process, giving teachers the confidence to plan lessons effectively based on gaps in students' learning across the computing curriculum. Alongside its Teach Computing Curriculum, the NCCE offers a comprehensive assessment suite for

KS3 and KS4 using the Eedi platform.

Time allocation in KS3 needs to be addressed. The British Computer Society (BCS) upholds that GCSE Computer

*"Informal learning is important to retain students' engagement in the subject. A break from traditional teaching behind a computer screen provides an opportunity to see where the technology they use comes from and inspire them."*

Science is a must, relevant to today's world and an ideal route into the digital future. With huge growth in the sector, high salaries in the offing, and a growing need for computing and digital skills in all sectors, it makes sense for schools to invest in computing, allow enough teaching time for their teachers to effectively deliver the subject, and to support those teachers' subject and pedagogical knowledge development.

There is talent and experience both inside and outside of any given school, so shortages of a specialist needn't be such a barrier. The NCCE has now seen over 1,700 teachers awarded a certificate via its Computer Science Accelerator (CSA) - a professional development programme designed to give computing and non-computing teachers the subject knowledge to teach computer science up to GCSE level.

We must now try to tackle misconceptions held by teachers and school leaders. Computer science is appropriate for every school, and should be available to all students. It is desirable, and necessary for all our futures, that all children should have the right to access computing at all levels of education and are fully enthused throughout. We need to get behind schools to ensure those barriers to delivering GCSE Computer Science are smashed down and remain down.

Visit our website for more information

■ <https://teachcomputing.org/>

## STEM AMBASSADOR SUPPORT

Booking STEM Ambassadors from industry to visit your school or deliver virtual engagement to your class is a great way to encourage enthusiasm and creativity within the subject.

■ <https://www.stem.org.uk/stem-ambassadors>

# STEM lift off

The context of space is a great way to engage young people with science and technology, as it links to so many aspects of the primary and secondary curriculum for all year groups. Here Greg Duffy, a teacher at Allestree Woodlands School, shares his school's experiences of using space-themed projects in the classroom. Allestree Woodlands is a coeducational academy secondary school and sixth form in Derbyshire.

## COMPETITIONS

Our sixth form students have been competing in the UK CanSat competition for six years now and have had the privilege of representing the UK at the ESA European CanSat Competitions in 2018 (Azores) and 2019 (Italy). The tremendous value for students from experiencing a full

space engineering project is difficult to over-estimate. On several occasions, their experience of the competition was key in securing places on apprenticeships at companies like Rolls Royce or STEM-related university courses.

One of our 2018 team members, Tom, said, "The competition

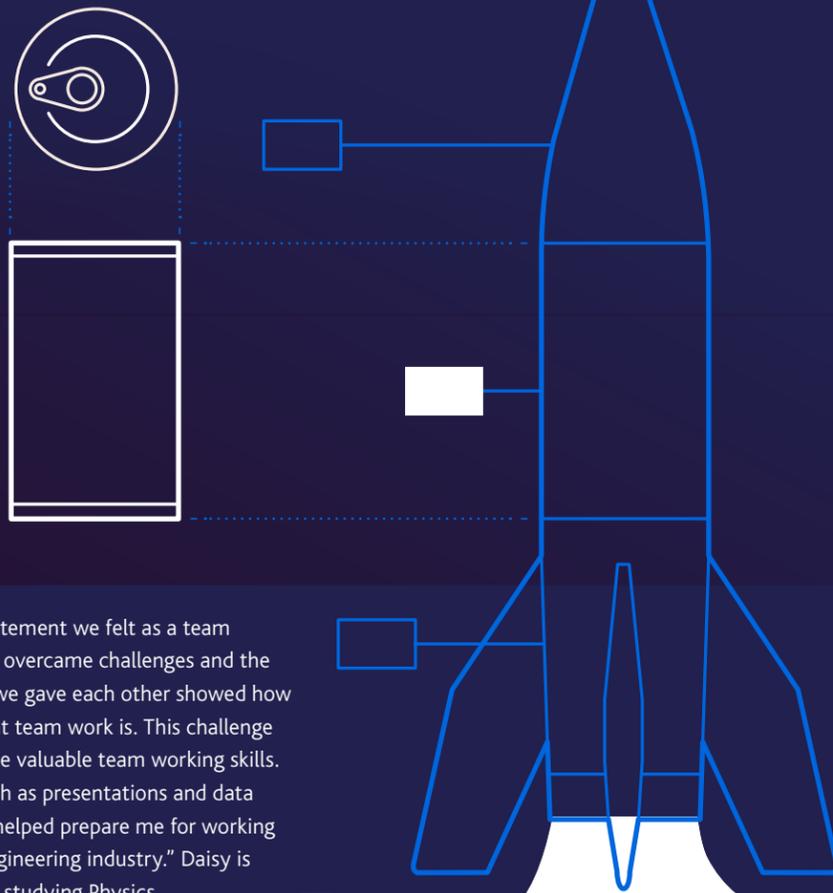
allowed us to get a feel for the challenges we may face if we decide to enter the space industry. CanSat got many students involved in STEM-related activities. We've gained insight into project planning, report writing and presenting – all invaluable skills."

Daisy, another past team member, said, "It gave me an insight into working in engineering.



"The excitement we felt as a team when we overcame challenges and the support we gave each other showed how important team work is. This challenge taught me valuable team working skills. Tasks such as presentations and data analysis helped prepare me for working in the engineering industry." Daisy is currently studying Physics with Astrophysics at the University of Leeds and hopes to work on satellites or space probes in the future.

"The excitement we felt as a team when we overcame challenges and the support we gave each other showed how important team work is."



## OUTREACH

Through the outreach aspects of the CanSat competition, we experienced first-hand the dramatic and enthusiastic responses of key stage 2 (age 7-11) children to space and other STEM activities. This, in addition to ongoing links with people in the UK space industry, led our school leadership to support the development of a Reception-to-19 Space Curriculum. The first stage of this was to gain the Space Education Quality Mark (SEQM).

The SEQM is an award given to both primary and secondary schools that have used the context of space to enhance learning across their setting, providing opportunities for exciting and engaging learning by bringing the curriculum to life with interesting links to the real world of space science.

The award criteria acted as an invaluable guide to focus our efforts in developing in-school space and STEM themes throughout the curriculum. The SEQM brought together existing space-themed curriculum activity

with new developments created by enthusiastic teachers and support staff. We were delighted to be awarded the SEQM and the plaque and certificate have pride of place in the school visitors' reception (along with the UK CanSat trophies!). There is a real sense of pride across the school community for these achievements.

Our next step was to engage partner primary schools in the SEQM process and the initial development of the Reception-to-19 Space Curriculum. We now have five partner primary schools working with us. Our first collaboration was the transition project 'To the moon', that engaged Year 6 students during the first COVID-19 lockdown and reduced anxiety relating to transition for many students.

The transition project culminated in the construction and launch of water-rockets by our new Year 7s. This event acted as the beginning of the Woodlands Rocketry club that will be building and launching model rockets. The Reception-to-19 Space Curriculum development continues this year with expansion to other primary year groups.

## COLLABORATION WITH UK SPACE INDUSTRY

We have established an ongoing collaboration with UK space company Vorticity and our students are working on an ongoing project to explore the potential of non-Newtonian polymers in impact protection for space missions; in particular, sample return missions.

Our students have been greatly motivated by the engagement with a real UK space company and the opportunity to present at space events, where the likes of Tim Peake (ESA), Jeremy Curtis (UKSA), Dr Arrun Saunders (Vorticity), Joanne Wheeler MBE (Space Lawyer) and Tim Tawney (NASA representative in Europe) were in attendance.

## TO THE MOON!

This chain-reaction of activities and enthusiasm for Space and STEM subjects amongst our students, staff and leadership team can be directly linked back to the inspirational work of ESERO-UK. Seeing the real and significant impact on student engagement, aspiration and achievement through involvement in STEM projects, leads our staff, students and school leadership to an inevitable conclusion; we need more space! To the moon!

■ [www.stem.org.uk/mag15s-esero-quality-mark](http://www.stem.org.uk/mag15s-esero-quality-mark)

## HOW TO PLAN AND RUN YOUR OWN SPACE WEEK

■ [www.stem.org.uk/system/files/elibrary-resources/2019/02/ESERO-SpaceWeek\\_booklet.pdf](http://www.stem.org.uk/system/files/elibrary-resources/2019/02/ESERO-SpaceWeek_booklet.pdf)



# Practical solutions to a practical problem

Science, by its nature, is inherently a practical subject. The circumstances around COVID-19 have led to challenges for the delivery of practical work in schools and colleges, with rota timetables, limited laboratory facilities and equipment availability. Admirably, teachers and technicians have risen to the challenge!

With a pragmatism that demonstrates the very best of our profession, we have seen novel and inventive solutions and a commitment to address the issues around practical work. From home-learning practical activities to microscale experiments and blended approaches, the necessity of continuing with practical science has driven the invention of supportive strategies.

However, it is important that our teachers and technicians are not left to navigate these challenges alone. STEM Learning, along with the Association for Science Education (ASE) and CLEAPSS, strongly believes that practical science education can and should be happening in the current climate – but that teachers and technicians should be provided with high-quality guidance and support to make this happen.

## SOME PRACTICAL ADVICE...

The ASE publication *Good Practical Science – making it happen post-COVID-19* has shone a new light on ten original benchmarks found in Gatsby's *Good Practical Science report of 2017*, providing suggestions on how each benchmark can be addressed and highlighting new opportunities that are emerging. Three of these benchmarks are discussed below.



### BENCHMARK 1: PLANNED PRACTICAL SCIENCE

As schools and colleges adapt to the 'new normal', there now comes a time for reflection and forward planning. The increasing role of home-based learning has highlighted social inequalities, with concerns around learners having adequate access to hardware, the internet or support structures. What is clear is that there will be a need not only to invest more in online classroom technology but also to support learners who may be at significant disadvantage and provide adequate training for staff, learners and parents in using digital home-learning technology effectively.

Teachers report that the most frequent purpose of practical work has been helping students understand theory or to provide motivation, with simulations or video clips often being used to augment or replace regular practical work. Much less commonly reported is the use of practical work to teach

skills, principles of enquiry, communication and teamwork. There have also been relatively few examples of open-ended investigations, fieldwork and citizen science activities.

Schools and colleges will need to plan opportunities to redress this balance and resist the temptation to concentrate solely on 'catching up on missed content' at the expense of developing students' practical understanding of science. Exploring the potential of the home learning or remote environments to facilitate activities that are difficult to organise in school (e.g. fieldwork, open-ended investigation activities provided by lunchtime or after school clubs and visits from STEM Ambassadors) is likely to enhance the practical experience for students.

### BENCHMARK 6: TECHNICAL SUPPORT

Provision of intensive CPD has allowed the role of technicians to expand, taking account of health and safety throughout the school or college. Increasingly, technicians are taking on a more active role with planning the science curriculum.

Greater collaboration and communication between head teachers, principals, heads of departments and technicians will allow more effective curriculum planning; practical activities can be reviewed and rationalised, new and more efficient methods of delivery can be explored and practical work that does not provide any benefits to learning can be removed in favour of new activities that do.



## BENCHMARK 7: REAL EXPERIMENTS, VIRTUAL ENHANCEMENTS

With the recent shift towards using simulations and video clips as a replacement for practical activities, it is crucial that careful planning takes place to ensure they are used effectively.

Many simulations, such as those provided by PhET, University of Colorado and the University of Reading, allow complex phenomena to be discussed and explored with students. Indeed, when used in the right way, they can sometimes be more effective than the real equivalent when it comes to understanding theory. Simulations can be paused, rewound and replayed with data sets being generated for use in subsequent analytical exercises.

What seems to be apparent is that personalised and home-made resources are more effective and better received by students than off-the-shelf commercial material. A range of software tools exist that can add voice-overs to PowerPoint presentations or video clips, or tailor existing video content into online lessons (eg ed.ted.com). Blending the use of virtual and real practical work requires skilful planning and the sharing of good practice amongst communities of teachers is crucial in developing these new skills.

## PRACTICAL WORK IN A POST-COVID ERA

The changes that have been thrust upon us by COVID-19 have forced a significant re-evaluation of practical teaching and learning. Despite the many challenges, we should feel encouraged to see the pace of innovation and refinement now taking place, which will no doubt serve to strengthen practical work well into a new era.

## FIND OUT MORE

- [www.ase.org.uk/news/ase-publishes-key-recommendations-practical-science-in-post-lockdown-world](http://www.ase.org.uk/news/ase-publishes-key-recommendations-practical-science-in-post-lockdown-world)
- [www.gatsby.org.uk/education/programmes/support-for-practical-science-in-schools](http://www.gatsby.org.uk/education/programmes/support-for-practical-science-in-schools)
- [phet.colorado.edu/en/simulations/filter?sort=alpha&view=grid](http://phet.colorado.edu/en/simulations/filter?sort=alpha&view=grid)
- [www.reading.ac.uk/virtualexperiments/experiments.html](http://www.reading.ac.uk/virtualexperiments/experiments.html)
- [ed.ted.com/](http://ed.ted.com/)

# Necessity is the mother of invention...

As a teacher, I discovered STEM innovation through necessity to keep my subject alive and of value to my school – at a time when the landscape for digital skills and ICT were in question by the DfE and therefore the SLT at my school. It was then that I discovered STEM Ambassadors.



Through research, I realised that by guiding my students and Code Club members to create their own projects, they could enter digital tech competitions and gain recognition for their skills. My theory was that if I raised the profile of the students and subjects in this way, then my school would rethink its strategy. At the time, there were lots of little tech competitions, all of which were encouraging students to come up with ideas to solve real-life problems.

Competitions are a fabulous motivational tool for students, but it was the STEM Ambassadors that inspired the students to flourish, as this engagement allowed for interaction with people from outside their school environment or life. Students felt boosted when working with STEM Ambassadors who genuinely wanted to know about their projects and wanted to share ways in which the projects and ideas could be improved.



My Code Club was no longer simply about coding but became a hub of different types of activity: a STEM Club – one where students could take their ideas further. My role as a teacher changed, from one where I was the deliverer of knowledge to one where I became the facilitator and was guiding them and pointing them in the right direction.

Over the years, I have seen some absolutely incredible projects from young junior students to older senior students. I feel strongly that creating a space where students can 'tinker', both with ideas and technology, is essential for innovation. A space where no idea is rejected and students can engage with STEM Ambassadors to learn from their real-life experiences and knowledge.

**“In actual fact the STEM Ambassadors inspired the students to flourish... they felt boosted when working with Ambassadors who genuinely wanted to know about their projects and wanted to share ways in which the projects and ideas could be improved.”**

The creative space for students was my computer lab. It was not ideal but I managed to change it to make it meet the needs of my students. I had a dedicated space for electronics, where I deliberately left out some of the kits so students could touch and feel them – as you don't know when an idea might spark in their minds. The walls and bookshelves were housed with materials to inspire students in the field of STEM. I had software installed on my PCs (3D design) and I had a section dedicated to STEM on the school VLE.

With the school day being so packed with lessons, clubs, events, rehearsals or fixtures it was clear that some students would never find the time to engage with, or explore, STEM. This led to the STEM Sunday initiative, where once a month I opened the computer labs to allow students to come in and work on their projects, individually

or in groups. I'd invite guest speakers, including STEM Ambassadors, to pop along for an hour to engage with the students and provide feedback for their projects.

One of the important aspects needed in education, I realise, is the importance of encouraging students to innovate. Through STEM Clubs and STEM-related activities, young people see the application of their learning and the reasons why they need to acquire different skills and subject matter knowledge in science and mathematics. Time and time again, I noticed those students engaged in STEM projects would take on the ownership for their own learning. Some students went from being someone who constantly needed encouragement to becoming someone who really wanted to learn and was fully engaged in their own learning.



Innovation is universally regarded as a key route to prosperity and societal development. Businesses and individuals spend considerable time, effort and money to develop new innovative products, services or solutions to maintain and improve their prospects. Now is the time to include innovation in your classrooms and schools and to use innovation to raise the aspirations of all young people.

- [www.stem.org.uk/mag15s-stem-clubs](http://www.stem.org.uk/mag15s-stem-clubs)
- <https://teachcomputing.org>

# STEM careers - where to start?

STEM careers are everywhere and their influence touches every part of our lives. But do most young people see themselves in a STEM-related role when they leave school?

With so many examples of jobs to choose from, how can we make sure that students have the right information they need to make an informed decision about their future career?

## SIX WAYS TO DEVELOP STEM CAREERS AWARENESS:

**1** Help your students to understand the importance of STEM in their lives and the lives of others.

Use examples from both the inspirational and the everyday to help students understand the importance of STEM subjects.

### How can I do this?

- connect topics and skills to the tasks that students might need to do in the future
- make links to local and global issues, such as climate change, air quality and healthcare



**2** Challenge students' and parents' perceptions that "STEM isn't for me".

Encourage all students to see the opportunities STEM gives them, regardless of gender, race or academic ability.

### How can I do this?

- include a wide variety of role models in images, resources and guest speakers
- talk about who can do jobs in STEM and what exam grades are needed

**3** Be aware of the wide range of roles available within STEM industries.

Highlighting a wide range of jobs linked to STEM employers will help students to see how the skills they develop across the STEM curriculum are relevant to their future employability, regardless of whether or not they choose a future in a STEM skilled role.

### How can I do this?

- create a wall display showing STEM careers and study routes that link to your subject from a range of sectors (like digital, healthcare, construction and biosciences)
- increase your own knowledge by working with your careers adviser, attending CPD and meeting employers at STEM Ambassador events

**4** Help students to see the value and transferability of STEM skills.

Show how STEM skills can be used in so many areas – in particular, mathematics and digital skills and provide examples of how these skills can support their wider employability.

### How can I do this?

- create opportunities for students to use numeracy and digital skills in lessons (like using the internet to research a topic, using budgets for challenges and competitions)
- plan a collaborative project with another department, linking science to PE by exploring how science can improve sporting performance



**5** Develop the employability skills needed to be successful in STEM employment.

Plan time in your curriculum to develop employability skills and highlight these opportunities to students.

### How can I do this?

- make employability skills visible in your classroom by downloading our Top 10 employability skills poster
- invite STEM Ambassadors to speak to students about how they and their colleagues use different employability skills in work

**6** Increase awareness of STEM specific study routes and labour market information.

Share labour market information and help students to learn more about STEM careers and the range of further study routes available to them.

### How can I do this?

- share your career story with students, including previous jobs and study routes
- provide students with examples of further study routes that link to a topic or lesson (like A levels, T levels, apprenticeships, degree routes and vocational qualifications)

Find more ideas and inspiration in our new resource – Developing career learning in STEM:

■ [www.stem.org.uk/mag15s-developing-career-learning-stem](http://www.stem.org.uk/mag15s-developing-career-learning-stem)

For more information on how STEM can be part of your school or college careers strategy, take a look at our new STEM Careers Toolkit:

■ [www.stem.org.uk/mag15s-stem-careers-toolkit-secondary](http://www.stem.org.uk/mag15s-stem-careers-toolkit-secondary)

# STEM CAREERS INSPIRATION FOR YOUR CLASSROOM

Support your students to:



Understand the importance of STEM in their lives and the lives of others



See the value and transferability of STEM skills



Challenge the perception that "STEM isn't for me"



Develop the employability skills needed to be successful in STEM employment



Be aware of a wide range of roles available within STEM industries



Increase awareness of STEM specific study routes and labour market information

## Resources for secondary schools and colleges



### Careers Leaders

Gain ideas for how STEM can support each of the Gatsby Careers Benchmarks.



### Teachers and Technicians

Find out how STEM career learning can link to your lessons and enrichment activities.



Download our free posters



Working in partnership with



Link careers to your STEM curriculum with our range of free resources, guidance and online training courses, available at [www.stem.org.uk/stem-careers](http://www.stem.org.uk/stem-careers)

# Approaches to improving GCSE maths resit outcomes: choose your own adventure

Imagine you are a student. Your mathematics teacher suggests that, with a bit of luck (and hard work and revision), you will pass your mathematics GCSE this summer. Fast-forward a couple of months and you are sat in the examination hall.

You're coming towards the end of the final GCSE Mathematics examination. The invigilator announces there are five minutes left. You've worked through the paper and answered everything you think you can. Do you...

(1) Decide you've done as much as possible. Put your head on the desk and snooze for the final five minutes. Go to Scenario A.

(2) Quickly flick through the paper and write anything you can think of in the gaps left; you never know, you might hit lucky and get one more mark. Go to Scenario B.

### RESULTS DAY:

Scenario B: well done, you got a grade 4 – you passed – just!

Scenario A: unlucky, you got a grade 3 – you failed and will have to retake next year.

What do you think your chances of passing next year will be?

Since 2014, students 'failing' GCSE Mathematics have to re-sit. 'Failing' is defined as not achieving a grade C or higher in the old grading system, or a grade 4 or higher in the current system.

Retake pass rates are low – less than a quarter of students resitting mathematics in 2019 achieved a grade 4, according to FE Week. The Smith review of post-16 mathematics (published in 2017), found that the "proportion of resit students passing (at grade C) or above has declined as entries have risen. Students taking GCSEs again have already experienced failure and may be less motivated or confident to achieve in the subject as a result. These challenges are most likely to be felt in FE (further education) colleges."

What is very apparent is the benefit to the economy of a system which produces young people who are confident and competent in their mathematics skills. The Industrial Strategy White Paper (also published in 2017) highlights the importance of young people developing appropriate mathematics skills, but how best can this be achieved?

There are many approaches, that have different merits and drawbacks:

- students simply cover the basics again? And practise, practise, practise until fluency is achieved?
- should the mathematical content be taught in context in order to make it more relevant to working life?
- should students retaking GCSE Mathematics do a different 'retake' exam?

Thankfully, help is at hand. Supported by the ERA Foundation, we are working with FE colleges to explore a different approach: developing a skills-based approach to the mathematics curriculum as opposed to a content-based approach. This different approach has a greater emphasis on reasoning skills, proportional reasoning skills and problem-solving skills. We are working to equip students with the transferable skills required in other areas of their study and beyond. With a more collaborative approach to learning mathematics, with the emphasis on developing skills rather than passing an examination, we hope to help students to develop a more positive attitude to learning mathematics.

Over the next two years, work will take place with mathematics departments in a number of FE colleges across England to develop confidence and positive attitudes towards learning in students, as they continue their mathematical journey.

You can find out more about the project on the STEM Learning website.

■ [www.stem.org.uk/news-and-views/news/supporting-mathematics-gcse-resits-further-education](http://www.stem.org.uk/news-and-views/news/supporting-mathematics-gcse-resits-further-education)

### FURTHER RESOURCES

■ [www.gov.uk/government/publications/smith-review-of-post-16-mathematics-report-and-government-response](http://www.gov.uk/government/publications/smith-review-of-post-16-mathematics-report-and-government-response)

■ [www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future](http://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future)

■ [www.erafoundation.org/](http://www.erafoundation.org/)

# Celebrating 25 years of helping students stand out from the crowd

Nuffield Research Placements (NRP), formerly known as Nuffield Science Bursaries, has supported approximately 20,000 post-16 students over the last 25 years to engage in real-life research working alongside STEM professionals.

The collaborative nature of NRP has seen young people work on a range of cutting-edge projects, from machine learning for obstacle detection and collision avoidance in robot boats, to investigating the onset of cognitive deficits in rat models for Alzheimer's disease and exploring the environment of supernova remnants. In summer 2020 alone, students were at the forefront of pandemic research.

For example, some students worked on computing projects using agent-based modelling to simulate and visualise how COVID-19 spreads in a crowd. Others had environmental projects that explored the impact of COVID-19 on air quality in Edinburgh or the growth rate of atmospheric carbon dioxide. Bioinformatic projects had students analysing different sequences of COVID-19 to work out amino acid changes whilst others engaged in relevant aspects, such as the impact of social distancing on young carers and analysis of coverage in US and UK print media.

All this inspiring work not only has a hugely positive effect on each student, but it also leads to fantastic opportunities. Nuffield students' work is regularly



"I have gained irreplaceable knowledge, I have made connections with multiple academics in a top Russell Group university. It has been a journey in independence, in expanding my ability to learn new things. I was unsure about doing the placement before but I am glad I did it because it has changed my life for the better."

• Student – Neale-Wade Academy, Cambridgeshire

published in peer-reviewed journals, as well as presented in UK and international competitions. Former Nuffield students have gone on to become Deputy Editor at the New Scientist, founder of the Youth STEM Summit and CEO of the Journal of Young Investigators to name but a few. One former student, now a professor of clinical and bioanalytical chemistry, hosts current students and has done since 2010, saying: "Inspiring the future generation into the field of research and developing their transferable skills was something I felt would be of great benefit to the students. It would also give them the glow and joy of what research can bring and hopefully spark their interest in a subject area".

We are excited that STEM Learning has now taken over the delivery of this highly regarded and prestigious programme, which puts students at the centre of innovative research and design, providing them with insights into future STEM or STEM-related education and career pathways. We do this at no financial cost to the school or host organisation thanks to ongoing funding from the Nuffield Foundation and support from UK Research and Innovation.

NRP is available to Year 12 (or equivalent) students from across the UK and from low socio-economic or first in family backgrounds. The NRP team focuses on supporting these students with a range of activities designed to equip and develop their STEM research, communication, data and digital skills. These activities sit alongside real-world collaboration



with a knowledge expert and optional supplementary workshops and webinars that are geared towards careers guidance and training on key topics, eg Python.

**We are proud to say that NRP has been shown to successfully target disadvantaged students and:**

- increase their likelihood of enrolling in a STEM course at a Russell Group higher education institution
- increase the number and quality of STEM A levels achieved
- improve student understanding of what STEM researchers do on a day-to-day basis
- enhance transferable skills, such as communication, time management and data skills

**The programme runs on an annual cycle:**

- **autumn/winter:** applications open and students approach one teacher to provide a reference alongside parents or guardians providing relevant eligibility information
- **spring:** application deadline closes, eligibility checks take place, placement matches are confirmed and students begin an independent study support package to be completed at their own pace
- **summer:** placements take place across the UK with all activities followed by celebration events to mark students' incredible achievements

"I think it is brilliant. Both of my students have difficult backgrounds and I think it has really helped them with life skills as well as giving them a career focus."

• Teacher – Our Lady's Catholic College, Lancaster

"This is an excellent accolade to discuss in their personal statements and pushed them to complete work outside of their comfort zone. [The students] have both shown increased confidence and resilience."

• Teacher – Camborne Science and International Academy, Cornwall

## SUPPORT YOUR STUDENTS

We hope to widen our reach to more students every year so if you would like to find out more about how you can support your students to apply, please scan this QR code or visit:

■ [www.stem.org.uk/nuffield-research-placements](http://www.stem.org.uk/nuffield-research-placements)



# STEM Community – a place to grow

To create a community, we need a place to gather. An inclusive environment for all to explore, a place to share our knowledge and experience.

That's why, in January 2021, STEM Learning launched an exciting new online community for everyone who is invested in STEM education.

STEM Community provides more than just a place to talk. It is a safe and professional space enabling ongoing support and problem solving for members, with input from peers and STEM Learning experts.



STEM Community is vibrant, practical and supportive. As a member of the Community, you can build a supportive network, explore ways to improve the quality of your teaching and offer your own expertise to others.

We are confident you will find STEM Community trustworthy and indispensable. It puts the power of STEM Learning's proven expertise and the professional experience of members into the hands of all members, wherever and whenever you need it.

Together, we are building an engaging community which benefits our real-world communities. Your professional growth, supported by STEM Community, will shape future STEM education practice on the ground, improving

outcomes for young people.

It's your STEM Community. There's so much that you – the members – will learn from each other and we are here to learn from you too. We are excited to find out what you will discover and share with your fellow members.

**If you haven't already joined the conversation, it's easy to make a start...**

- sign up (<https://community.stem.org.uk>) or download the [iOS App](#) or [Android App](#) by searching 'STEM Community'
- join groups
- participate in an existing discussion – or start your own
- receive recognition for your contribution

**STEM Community: Connect. Share. Shape. Develop.**



Welcome to the **STEM Community**. It's a safe, professional space for you to collaborate with fellow professionals. As members of the community, you can build a supportive network and explore ways to improve the quality of your teaching.



## Supporting early career teachers in your school

It has been a challenging first year for trainee teachers and NQTs. There has been less opportunity for those 'staffroom chats' with more experienced teachers who can serve to build the confidence of early career teachers by providing teaching ideas, talking through strategies to engage a range of students, or simply being there to bounce ideas off.

For example, early career teachers can find some topics appear dry initially when they have yet to gain the subject knowledge to incorporate interesting contexts, explanations for 'why we should learn this' or simple demonstrations to illustrate a concept. This is where access to experienced subject specialists is invaluable.

By being proactive within STEM Community and asking for help, early career teachers gain access to a national network of experienced subject specialists, including professional development leaders at STEM Learning and from our Science Learning Partnership schools.

"There has been less opportunity for those 'staffroom chats' with more experienced teachers who can serve to build the confidence of early career teachers by providing teaching ideas, talking through strategies to engage a range of students, or simply being there to bounce ideas off."

Here's an example:

Hi all,

*I'm teaching the chemistry topic 'The rate and extent of chemical change' for the first time next week. They're a high ability Year 10 class. As I am a trainee (and not a chemist), the class teacher has already covered calculating rates of reactions and catalysts. I am to teach collision theory/activation energy and reversible reactions/dynamic equilibrium.*

*I was thinking I would be able to demonstrate some practical work to aid student understanding, but now with online learning I won't be able to do this. Please can anyone help me out with any resources or ideas for teaching this topic online? Do you have any top tips for teaching this topic also (eg common areas students struggle with so I can address these in class)?*

Thanks,  
Vicky

# STEM Community – a place to grow



## The benefits of collaborating online

Of course, there are benefits of learning online together, rather than trying to catch a colleague at lunchtime, or between lessons, in the corridor!



- the flexibility of being able to access support, when and where it suits you. The STEM Community app helps with meeting those immediate needs
- being able to access a far wider set of viewpoints, and

examples of strategies from teachers and schools across the country, can help you to enrich your curriculum with new ideas and reflect on practice

- with so many different organisations feeding into STEM Community, you can keep up to date with free, online events for children to add to your calendar, the latest news and announcements about new resources

## Powerful professional conversations

Although we are in the early days of STEM Community, it is already fascinating to see how discussions evolve or are evolving as more varied opinions are added.

Discussions reveal patterns of what is salient and topical for members at a particular time. For example, when we launched in January, there was a lot of discussion on how to support each other through remote teaching.

“I have really enjoyed participating in the STEM Community forums. It is so refreshing to be able to discuss teaching and learning strategies, ideas for new practicals and new activities, and cross-curricular links between the STEM subjects with like-minded individuals.”

–Chris Catto

“I have loved taking part in the different discussions – and hearing how others are implementing ideas in their practice. It has also been interesting getting feedback from others and being able to take thoughts back for further discussion.

“It has been particularly rewarding being able to draw people into discussion and seeing them engage with a wider audience, thereby building their own contacts and networks. I am excited to see how the community continues to develop.”

–Sarah Longshaw

“I have enjoyed sharing ideas on others’ threads and members commenting on my post. I have picked up a number of useful weblinks and ideas to share and a number of other things that have got me thinking about my practice or STEM education in general.”

–Henry Hammond



## Looking ahead

Given that STEM Learning is the UK’s largest provider of education and careers support in science, technology, engineering and mathematics, you will not be surprised to hear that we have strong ambitions for STEM Community.

We want STEM Community to be the definitive place you come to engage with others in STEM education, to seek and offer solutions and to report back on your revised classroom practice.

Together, we can build something really special which shapes a bright future for STEM education and inspires the next generation to take their interest in STEM subjects further.

■ <https://community.stem.org.uk>

## Tips on using STEM Community

- remember that we are all busy people, so include a clear, concise subject line if you start a new discussion – this makes it easy and quick for everyone to see exactly what your question or discussion is about without having to open it
- you can control your notification settings to keep abreast of new discussions:
  1. go to your profile
  2. select ‘My Account’
  3. select ‘Community Notifications’
  4. choose your settings for each group you have joined
- if you are replying to a specific person in a discussion, type @name in your reply and they will get a notification that you have answered them or asked them a question



# 50+ STEM activities for any classroom



Running a STEM Club or offering STEM enrichment activities before, during or after the school day can bring immense benefits to students, teachers and schools, helping to support curriculum learning and embed subject knowledge.

They are a perfect combination of scientific research, investigation and practical hands-on activity, using fun and engaging projects to reinforce curricular learning within a topic or theme that encourages and inspires students to stretch their capabilities. They create opportunities to learn new skills, boost confidence and place subjects in context within the wider world.

If students enjoy a subject, they will naturally seek to learn more and try out new things. If they can understand how it fits within the world around them, they see its importance and potential. This reflects back within the classroom.

STEM enrichment, whatever its form, can often reinvigorate a teacher's own enjoyment, expand their subject knowledge and lead to enhanced skill sets of their own.

Yet, for many teachers, time, equipment, confidence and even subject knowledge can be potential barriers. Knowing where to start and what to do can be difficult, and this is especially true when curricular learning is restricted by circumstances beyond your control.

The STEM Clubs programme supports teachers of all abilities and subject expertise to engage with STEM enrichment in the following ways:

## 50+ SECONDARY LEVEL STEM ACTIVITIES FOR ANY CLASSROOM

A set of resources that can be easily carried out by all school staff, families, club leaders and STEM Ambassadors, and in any setting, irrespective of subject experience or knowledge. It helps to broaden the reach of STEM subjects, enriching the curriculum and increasing enjoyment for everyone involved. The activities can be adapted to suit the time and setting available, requiring few resources or materials. The list includes fun projects such as building a small telescope or holographic images, planning an apocalyptic meal, designing shoe covers to run quietly through the school and designing a wing to enable humans to fly.

■ [www.stem.org.uk/rxgqsj](http://www.stem.org.uk/rxgqsj)

## STEM CLUB SESSIONS

We host a series of pre-recorded sessions, which anyone can join in on. The STEM Club activities – hosted on YouTube – are delivered by teachers, technicians, STEM Ambassadors, STEM Learning staff and through collaboration with STEM organisations. Each session contains between four and six practical activities that can be done at home or within a classroom. Teachers can use the videos within their lessons, fill a gap in the timetable or direct students to do the activity at home.

■ [www.stem.org.uk/mag15s-national-stem-club](http://www.stem.org.uk/mag15s-national-stem-club)



## STEM CLUB WEBINARS

Our webinars cover a variety of topics, such as setting up and running a STEM Club during a pandemic, how to apply for funding, running competitions and challenges, how to incorporate careers knowledge and employability skills, to running a club for SEN students. The webinars are hosted by experts from a wide variety of backgrounds, school clubs, STEM organisations, the STEM Ambassador programme, etc – all keen to share a wealth of knowledge and experience, opening up conversation, debate and collaboration whilst offering much-needed support.

■ [www.stem.org.uk/mag15s-stem-club-webinars](http://www.stem.org.uk/mag15s-stem-club-webinars)

Together, this programme of support will enable any school to offer a STEM Club experience and STEM enrichment activity to their students, whether at home or in the classroom, helping to consolidate the curriculum and increase the STEM capital of every family in the school community.

# Online courses for teachers

Focus on your professional development goals, by learning wherever and whenever suits you. Join our flexible, self-paced online courses.

Learn from leading experts and gain insights from experienced teachers. Through structured activities, videos of real classroom teaching, and reflective tasks, you will be able to make evidence-informed changes to your classroom practice.

Build your confidence in managing behaviour, discover how to maximise pupils' progress through formative assessment, develop your subject knowledge and approach to teaching practical science and work with colleagues to shape your curriculum.

Whether you're a trainee, newly qualified or an experienced teacher, join us online to develop your teaching of STEM subjects, with online CPD from STEM Learning.

"Watching the teachers in the videos using the different strategies was really helpful and gave an insight into how easily they worked."

– Participant feedback, Planning for learning: formative assessment

"I thoroughly enjoyed taking part in the course and feel it has had a positive impact on my teaching."

– Participant feedback, Introducing assessment for learning

Upon completion of CPD with STEM Learning, you will receive a STEM Certificate which, awarded digitally, will showcase your achievements and help you build a profile of your skills and knowledge.

Improving lives through world-leading science, technology, engineering and mathematics education.

[www.stem.org.uk/online-cpd](http://www.stem.org.uk/online-cpd)



# #DTenthusED – D&T online community



Whilst Joe Wicks MBE was engaging the nation in doing 'PE with Joe', Liz Allton spotted an opportunity to bring online training to the nation with #DTenthusED. A few months on, her hashtag is trending on social media and attracting teachers from across the world to her programme of online training.



We asked Liz to share her experience of setting up online training for teachers with support from an ENTHUSE Partnership, and to give us some top tips for how other schools can do it themselves.

## WHAT IS #DTenthusED?

#DTenthusED is subject-specific training for design and technology (D&T) teachers that we host for free on Zoom. We hold between two and four sessions per half term, focusing on a different element of the curriculum each time. Teachers can either take part live or download the session to watch at a later date. We advertise the sessions on social media and teachers sign up online to get access to the event and any resources that the presenters share.

## HOW DID YOU COME UP WITH THE IDEA?

The idea was our response to learning during lockdown. As the lead for CPD in my school, I always have an eye on what CPD is available for our staff to take part in. I noticed that there was a lot of content for other subjects but, at the time, nothing subject-specific seemed to be available for D&T, so I spoke to my head teacher and my department about setting up our own training. We initially started it to support the D&T teachers from across the Trust, but word spread and it quickly opened up to teachers from elsewhere. Teachers dial in from as far away as Dubai, but I'd say the majority of teachers definitely come from schools across England.

## HOW DID YOU CHOOSE THE NAME?

Firstly, it's a D&T initiative, so that influenced the title name. I also wanted to reference the #researchED content that I've been

getting involved with on Twitter. We initially set this up with support from the ENTHUSE Partnership that we are running, so squeezing that into the title gave us #DTenthusED!

## WHAT'S BEEN THE RESPONSE FROM THE TEACHING COMMUNITY?

We've been blown away by the feedback that we've received so far. Using #DTenthusED, we can track the conversation on social media and find out how each session is received. It's incredible to think that our school in Coventry is supporting schools from across the world.

We've also received a lot of emails from teachers thanking us. One of the biggest successes for me is that we have provided a virtual community for D&T teachers who are the only subject specialist in their school. We always include a breakout opportunity within each session so that teachers can network with each other and share ideas about the content. If you are on your own in a department or working with a team of non-specialists, sometimes having a fellow subject specialist to speak to and share ideas with is all you need to feel part of a subject community.



## WHAT'S NEXT?

We started the programme with some big topics that we knew would be of interest to a wide range of teachers. The next phase of the programme will look at more specific content from different parts of the curriculum. I'm also working on bringing an industry perspective to the sessions, by inviting guest speakers from university departments and STEM Ambassadors.

## FIND OUT MORE

- Search #DTenthusED on Twitter

## Top tips: delivering online support

- keep it short and to time, as people are busy, so we limit everything to an hour
- use online software that you are familiar with and keep it simple
- use the text chat to capture questions as you go – this means you can mute everyone except the presenter and make sure you avoid any background noise
- use surveys and social media to gather feedback on the sessions
- run sessions that you and your department will find useful. If you find the content interesting, then it's likely other subject specialists will find it interesting too!

## ENTHUSE PARTNERSHIPS

Liz set up #DTenthusED with support from an ENTHUSE Partnership. ENTHUSE Partnerships enable groups of schools and colleges to work together to improve young people's achievement and engagement in STEM.

- Find out more at [www.stem.org.uk/enthuse-partnerships](http://www.stem.org.uk/enthuse-partnerships)



# Climate Change Education Partnership

In November, the UK will host the 26th UN Climate Change Conference of the Parties (COP26) in Glasgow, the first of its kind in the UK, and the aim of the summit is to bring together world leaders to commit to urgent global climate action.

In the run-up to the summit, COP26 will be working closely with businesses, civil society groups, schools and members of the public across the UK as part of the conversation on tackling climate change.

With this in mind, a new Climate Change Education Partnership (CCEP) is bringing together partners from education, research and the wider STEM sector to support climate change-related lessons and activities in formal and informal education settings. The Partnership aims to increase teachers' subject knowledge and understanding, so that lessons are based on scientific evidence and increase students' understanding of the science and implications of climate change. The Partnership will particularly seek to support activities which focus on inspiring and engaging audiences who are underrepresented



within the STEM sector and will provide educators with training, resources and lesson ideas, trained volunteers and support for enrichment activities and challenges.

The Partnership currently consists of representatives from the Department for Business, Energy and Industrial Strategy, the UK Space Agency, UK Research and Innovation, the Met Office, the Environment Agency, the Natural Environment Research Council, the Royal Geographical Society and the Royal Meteorological Society.

Through this new programme, young people's knowledge of the science and impact of climate change, as well as their appreciation for research and innovation's impact on society, will be increased. We're also

aiming to increase young people's resilience and the number of young people from underrepresented backgrounds who study and engage with STEM subjects in the future.

### CHANGE THE CONVERSATION

Many people have already made changes to their lives to help the environment, such as choosing electric cars and buying products with less plastic packaging. In industry, engineers have developed offshore wind farms to power our homes, and businesses have increased investment in energy-saving measures and solar power.

Schools are already taking measures to ensure they're as energy-efficient as possible. When thinking about the energy-saving and environmentally friendly measures in your school, why not ask your students questions about the environment around them, getting them to think about how these things might be applied in their daily

lives and how they might talk about these issues with their families?

- are there signs around school to remind everyone to turn off lights and taps?
- discuss food waste and what happens to leftover food at lunchtime
- is there a way to compost food waste at your school?
- discuss how your school is heated and how to make it more efficient
- is there a way to use cars less?
- are there alternative options to reduce plastic usage in supermarkets?
- could we recycle more at home?
- what are our clothes made from?

## Climate change resources

Using the context of climate change in your teaching can demonstrate to young people how they can make a positive contribution to climate change.



### GRAND CHALLENGES

Artificial intelligence, ageing society, clean growth and future mobility are set to transform the way we live our everyday lives. We have resources to improve students' knowledge of future career opportunities, the types of STEM skills that are needed and how they can gain those skills.

■ [www.stem.org.uk/mag15s-grand-challenges](http://www.stem.org.uk/mag15s-grand-challenges)

### HOW CAN BIOLOGY AND CHEMISTRY FIGHT CLIMATE CHANGE?

Students generate and share ideas about how STEM can help solve a key challenge or answer a big question about the future, particularly as it relates to climate change.

■ [www.stem.org.uk/mag15s-save-world-stem](http://www.stem.org.uk/mag15s-save-world-stem)

### EXTREME SURVIVORS

Investigate extremophiles to see what qualities allow them to live in extreme conditions.

■ [www.stem.org.uk/mag15s-survive-asteroid-impact](http://www.stem.org.uk/mag15s-survive-asteroid-impact)

### THERE'S AN APP FOR THAT

Students learn about the effects of waste on the environment and try to find a way to incentivise recycling by designing

an app that allows households to log how much material they are recycling each week, where points will be given depending on the amount of recycling that is done.

■ [www.stem.org.uk/mag15s-how-can-we-live-smarter](http://www.stem.org.uk/mag15s-how-can-we-live-smarter)



This year is being hailed as the year of climate action and our new schools programme will support climate change-related lessons and activities in formal and informal education settings. Let us know what specific support you would like in your school via [climate@stem.org.uk](mailto:climate@stem.org.uk)



Visit our website  
[www.stem.org.uk](http://www.stem.org.uk)

Join us on Twitter  
[@STEMLearningUK](https://twitter.com/STEMLearningUK)

