

Primary

STEM Learning Magazine • Edition 15



World-class CPD, inspiration and resources from STEM Learning



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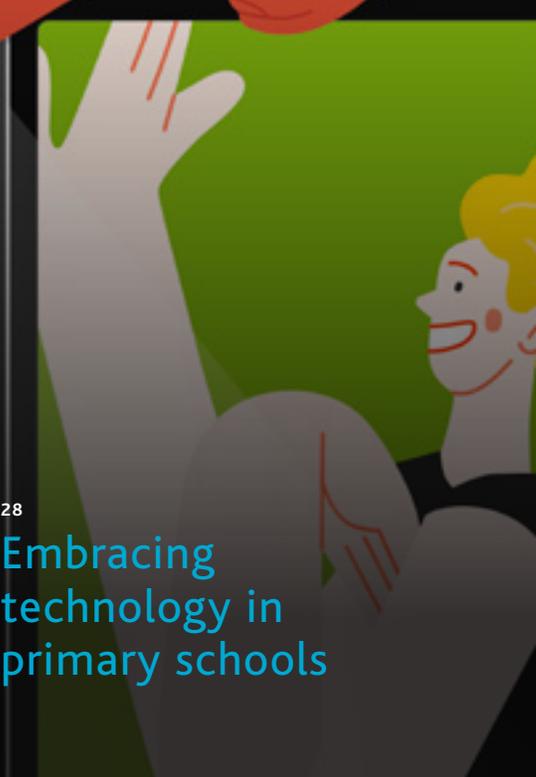
Narrowing the gap

20

STEM Community - a place to grow

28

Embracing technology in primary schools



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

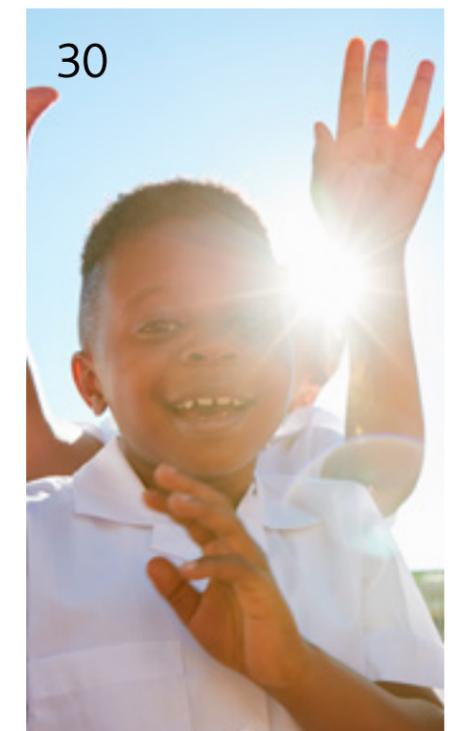
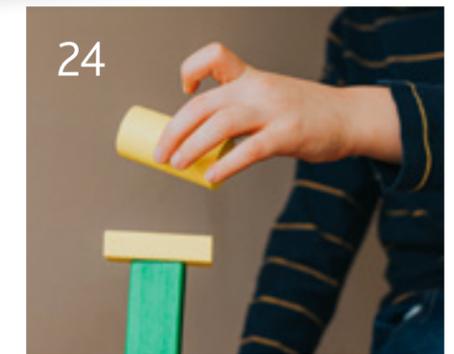
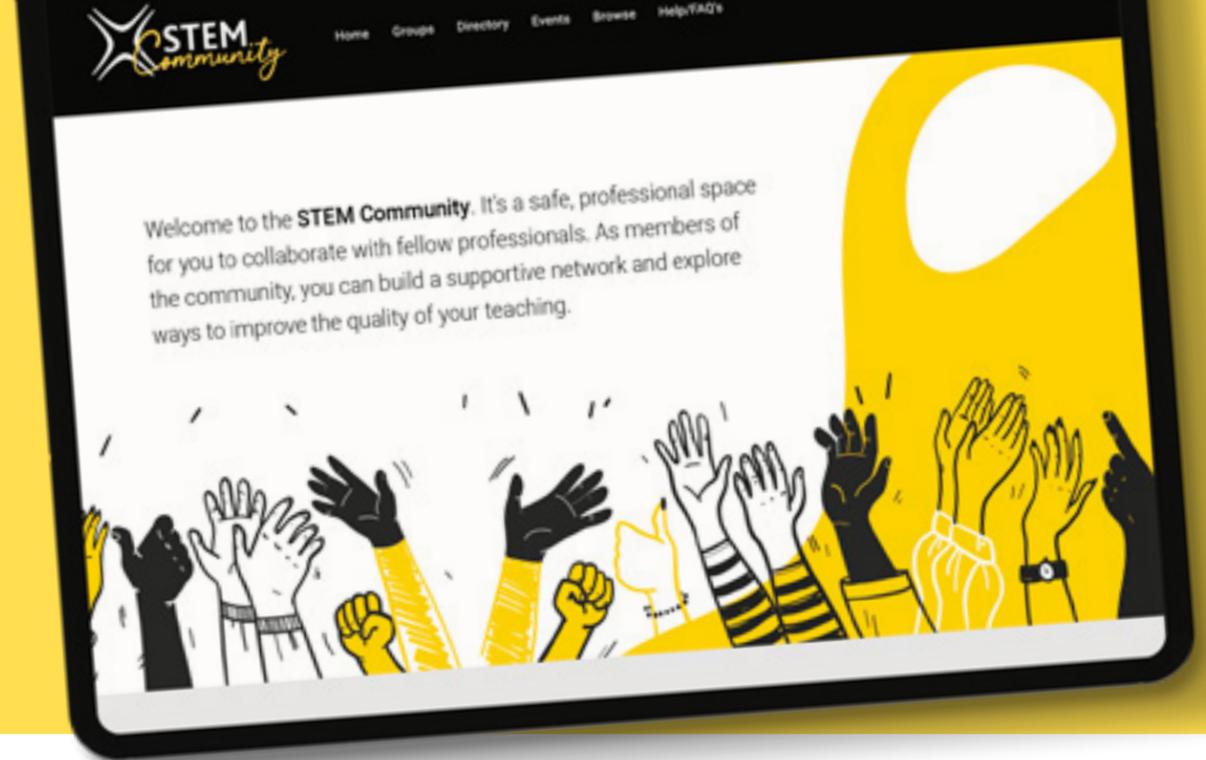


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Contents

- 4 At the heart of education lies collaboration
- 6 Narrowing the gap
- 8 Maximising the classroom impact of continuing professional development
- 10 Climate Change Education Partnership
- 12 Primary computing leads – champions of change
- 14 STEM Ambassadors: healthcare superheroes!
- 18 Solving word problems
- 20 STEM Community – a place to grow
- 24 Starters for STEM
- 26 Bring the fascination of Mars into your classroom
- 28 Embracing technology in primary schools
- 30 Support mental health by taking science outside
- 32 STEM lift off

20



A digital version of this magazine is available on our website: www.stem.org.uk/mag15p-digital

At the heart of education lies collaboration



In an effort to improve educational outcomes and help pupils 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 coronavirus 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.

In recent months, 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 pre-coronavirus 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 and 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 and 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, 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 in this. 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/

Narrowing the gap

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

The Education Policy Institute annual report (2020) found that the attainment gap between disadvantaged pupils 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 pupils, 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 pupils 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 pupils 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 pupils by promoting effective strategies that are known to work. The report *Supporting the attainment of disadvantaged pupils: articulating success and good practice research* (Department for Education (DfE), 2015) investigated the role of school strategies and approaches in raising disadvantaged pupils' 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 pupils for all aspects of life, not just exams

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

- paired or small group additional teaching
- improving feedback to pupils
- 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 pupils. 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 pupils
- **oral language interventions** – reading aloud and book discussion with young children, extending pupils' spoken vocabulary, using structured questioning to develop reading comprehension

To make progress in raising attainment for disadvantaged pupils, 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 pupils 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

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

The DfE study identified seven building blocks for this success:

- 1 Promote an **ethos of attainment for all**, rather than stereotyping disadvantaged pupils
- 2 Treat pupils on a **case-by-case basis**, addressing their barriers to learning and giving 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 pupils**, rather than providing different strategies
- 5 Deploy the **best staff to support disadvantaged pupils**; 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 pupils 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 pupils.

CPD also provides time and space to reflect on the needs of your pupils 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 pupil outcomes, and understanding the conditions in which this occurs. While attainment is of massive importance, there are a multitude of pupil 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
- pupils may develop transferable skills, deeper understanding or flexible knowledge, where the impact is more widely felt over the medium to long term
- pupils 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 pupils 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 pupil outcomes in the long term.

The most immediate impact of CPD is on the participants themselves, with the ripples extending outwards to their colleagues, pupils 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 pupil 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 primary:

■ www.stem.org.uk/mag15p-evaluating-new-teaching-practices-primary

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

■ <http://ncce.io/mag15p-course30>

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 pupils' 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 pupils 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?



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.



EXTREME ELEMENTS

In this collection of activities, pupils will make models to help them understand how weather and extreme events occur, and what their impact can be. They'll apply what they observe to real-world situations, designing structures that protect humans and respond to the elements.

www.stem.org.uk/mag15p-extreme-elements



POCKET SIZED POWER

Explore how movement is used to generate electricity by making their own simple generator.

www.stem.org.uk/mag15p-future-world (page 4)

GRASSHOPPER BURGER ANYONE?

Carry out a survey to see what people think about some of the possible things we might be eating in the future.

www.stem.org.uk/mag15p-future-world (page 22)

DOES MY OUTFIT LOOK RUBBISH?

Discover what materials our clothes are made from, and how they could be recycled.

www.stem.org.uk/mag15p-future-world (page 7)

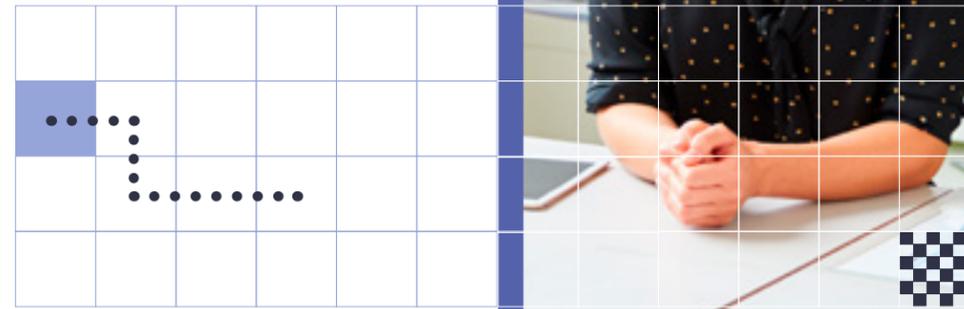
BROKEN FOOD CHAIN

Use computer modelling to simulate a broken food chain.

www.stem.org.uk/mag15p-animal-adaptations (page 36)

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.

Primary computing leads – champions of change



From September 2014, primary schools were expected to deliver a rigorous new computing curriculum. The changes ensured primary school children would have practical experience of designing and writing computer programs, so that they could understand the fundamental principles of computer science.

Primary school teacher, Louise Wade, shares her experience of the early stages of the computing curriculum implementation in her school and reflects on her personal subject and pedagogical knowledge development.



A self-confessed social media 'lurker', I have benefited from a community of practitioners sharing regular engaging content on social media. By establishing my own personal learning network on Twitter, I was able to keep up-to-date with ideas and resources which I've found particularly useful.

All this online community support and my learning journey has encouraged me to reflect on how to deliver a high-quality computing education. The early days – trying to understand the demands of the 'new' curriculum; what to teach, when and in what order – seem a distant memory now.

The excellent Teach Computing resources helped improve and balance my curriculum, and this was reflected in the children's enthusiasm for the subject and the improvement in pupil outcomes. Yet there is still much work to be done.

The 2019 Ofsted inspection framework makes clear the high ambitions we need for all our children. Stating the curriculum should be 'designed to give all learners, particularly the most disadvantaged and those with special educational needs and/or disabilities (SEND), the knowledge and cultural

capital they need to succeed in life'. No child is to be excluded or left behind.

2020 presented many new challenges for teachers and young people – not least the expectation to deliver and engage with a rich online curriculum that not only needed a physical device – but the digital skills and knowledge to use it safely.

Learning from home has been a success for our school. However, if blended learning is here to stay, I find myself asking – what is the future significance of this method of delivering the curriculum and how will it impact the achievement of children from all backgrounds and abilities?

Before the pandemic, the Government had already highlighted the need for a workforce educated for the digital world. This will require convincing more schools to teach computing and more young people to take up the subject at GCSE, A level and at university. The positive news is that we have started to make some progress with the increase in girls taking GCSE Computer Science.

"The Teach Computing resources helped improve and balance my curriculum, and this was reflected in the children's enthusiasm for the subject and the improvement in pupil outcomes."

All of this is food for thought and a heavy load to be placed on the shoulders of the primary computing lead. A role that has seen its responsibilities go from informal technology advocate and trouble-shooter, to managing a blended curriculum, with the responsibility for ensuring the engagement of all stakeholders.

Teachers are always thinking of new ways to engage pupils who are not succeeding and to close the achievement gap that other areas of the curriculum are facing. Is it reasonable to think we could apply the same strategies to reduce the achievement gap within computing?

Useful courses and reports

TEACH COMPUTING COURSE - OUTSTANDING PRIMARY COMPUTING FOR ALL
■ <https://teachcomputing.org/courses/CP005/outstanding-primary-computing-for-all-face-to-face>

TEACH COMPUTING CURRICULUM KEY STAGE 1
■ <https://teachcomputing.org/curriculum/key-stage-1>

TEACH COMPUTING CURRICULUM KEY STAGE 2
■ <https://teachcomputing.org/curriculum/key-stage-2>

NO LONGER OPTIONAL: EMPLOYER DEMAND FOR DIGITAL SKILLS
■ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/807830/No_Longer_Optional_Employer_Demand_for_Digital_Skills.pdf

IT'S LEARNING, JUST NOT AS WE KNOW IT
■ www.accenture.com/gb-en/insights/future-workforce/transforming-learning

CLOSING THE GAP WITH THE NEW PRIMARY NATIONAL CURRICULUM
■ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/349288/closing-the-gap-with-the-new-primary-national-curriculum.pdf

SUPPORTING THE ATTAINMENT OF DISADVANTAGED PUPILS: ARTICULATING SUCCESS AND GOOD PRACTICE
■ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/473975/DFE-RB411_Supporting_the_attainment_of_disadvantaged_pupils_brief.pdf

AFTER THE REBOOT: COMPUTING EDUCATION IN UK SCHOOLS
■ <https://royalsociety.org/-/media/policy/projects/computing-education/computing-education-report.pdf>

STEM Ambassadors: healthcare superheroes!



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

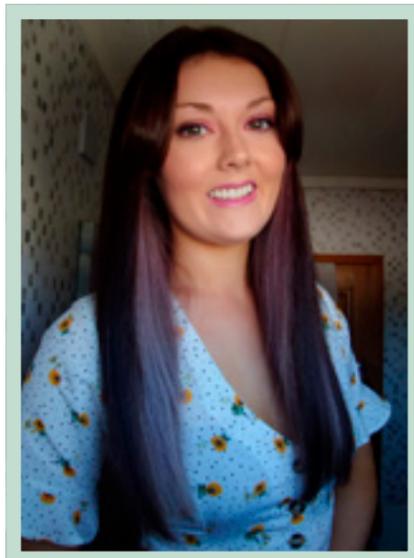
From bioscience lecturers to engineers and therapeutic radiographers, in this article, we shine a light on some of the fantastic STEM Ambassadors who work in the healthcare jobs your pupils might not have heard of yet!

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.

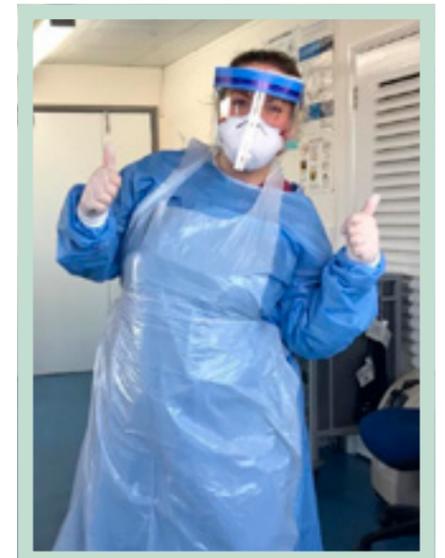
KIMBERLEY LEWIS, Specialised Respiratory Physiologist at Powys Teaching Health Board

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 – pupils 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.

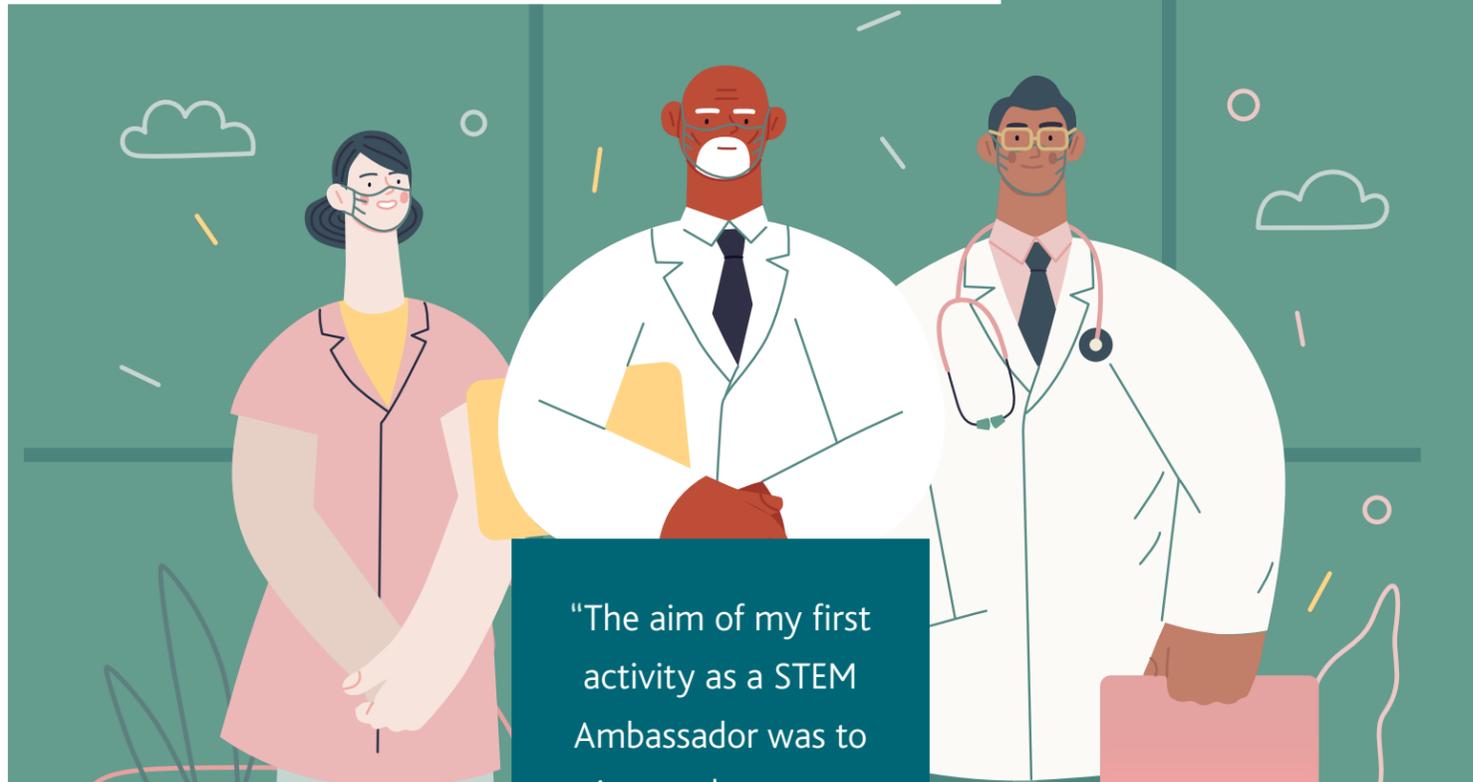


I use engineering principles to determine the durability of surgical instruments and implants, with large hydraulic machines applying compressive, tensile and torsional loads; testing the resistance of samples

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 pupils.



"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 pupils 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 pupils 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.

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 pupils, 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/mag15p-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/mag15p-stem-ambassadors-inspiration

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 pupils 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 pupils. 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 pupils.

FOOD & NUTRITION RESOURCES

- www.stem.org.uk/mag15p-great-british-space-dinner
- www.stem.org.uk/mag15p-animals-including-humans
- www.stem.org.uk/mag15p-animals-including-humans-year-6
- www.stem.org.uk/mag15p-animals-including-humans-year-3

CAREERS RESOURCES

STEM resources

■ www.stem.org.uk/mag15p-careers

Teachers guide

■ www.stem.org.uk/mag15p-career-learning-stem

Solving word problems

There are many reasons why so many pupils find solving word problems difficult. For some, it is the amount and level of reading involved or the mathematical vocabulary that is a barrier to understanding.

For others, it is an unfamiliar context in which they have no real-life experience, so they may quickly disregard the question.

But solving a problem is about understanding it and working out the steps involved to reach the answer, and this is where many pupils struggle to know where to begin. So, what can we do to help children learn how to solve word problems?

Research (Knapp, 2020) shows that most children only read a question once and skim over any charts, tables or diagrams, often ignoring labels and titles. Instead, many do what Hegarty (1995) describes as 'number grabbing' – taking the numbers out of a question and throwing them into a calculation without full comprehension of what they are doing and why.

The difficulties lie in translating the word problem to a mathematical representation because pupils focus on the numbers rather than the information. Therefore, acronyms such as RUCSAC (read, underline, calculate, solve, answer, check) are not effective because of the huge conceptual jump from underlining to knowing what to calculate.

One of the things that I have been exploring in my classroom is the use of 'goal free' problems. These, as the name suggests, are word problems that include the information and numbers required but do not have the final 'goal' or question to solve. They are easily created for any year group, taking a question maybe from a SATs paper or bank of word problems and removing the question, usually found at the end. Most questions are suitable, including those requiring single or multi-step solutions, those that involve reading charts or graphs and ones with a geometry concept.

Eliminating the 'goal' means that children no longer have to focus on finding an answer but instead focus on the information that they have in front of them, initiating valuable discussion opportunities.

Questions to ask the children could include:

- what information does this give you?
- what do you notice or wonder?
- given this information, what questions could we answer? How do you know? How would you work that out?
- what questions could we not answer? What extra information would we need to be able to answer that?

After modelling an example to the class, pupils can work in pairs or small groups with the information or graph in the centre of a large piece of paper and then write their own questions around it, or use as a whole-class activity to pool ideas. Younger children could be given a photograph to use instead of a written problem, such as a picture of a plate of biscuits or prices of items at a shop, and asked about what they can see. The teacher could scribe their ideas and start to formulate possible questions with them. Pupils could then sort their questions in different ways – perhaps by calculation type, by the number of steps

involved, by questions with similar structures or ones where they must use known facts.

Once pupils have explored the possible questions that can and cannot be solved from the given information, the actual question can then be revealed. Frequently, this is a question that they have already considered but, because they have investigated different possibilities rather than a specific goal, they have concentrated much more on different problem structures.

SO, WHAT HAS BEEN THE IMPACT OF USING GOAL FREE PROBLEMS?

After regular use, the difference in confidence, resilience and progress is very noticeable. Pupils who struggle because their level of fluency is not secure enough have had the cognitive load reduced significantly; they feel free to explore the problem. 'Number grabbing' has been replaced with increased visualisation and thinking about the questions as 'stories', resulting in improved comprehension and understanding of the problems. The flexibility in the questions has produced valuable mathematics talk and given opportunities to identify misconceptions in mathematical vocabulary.

Those children who usually solve word problems more easily are taken out of their comfort zone and tasked to

write their own questions to fit the information given, and they enjoy the challenge of 'Can you create the hardest question you can think of to ask a friend?' It also means they are less focused on always having the answer first, which can be demotivating for other pupils.

We teach pupils the skills and maths concepts that they need to answer questions but we cannot expect pupils to instinctively know how to solve word problems, so why not have a go at using goal free questions with your class?

MASTERY IN PRIMARY MATHEMATICS

■ www.stem.org.uk/cpd/480697/mastery-primary-mathematics

TEACHING PRIMARY MATHEMATICS FOR NEW AND RECENTLY QUALIFIED TEACHERS

■ www.stem.org.uk/my006

PRIMARY MATHS RESOURCES

■ www.stem.org.uk/primary-maths

2016 KS1 reasoning paper

Sam's money box has these coins in it.



Original question:
How much money does he have?

Goal free question:
What do you notice?

2018 KS2 reasoning paper

Max goes to the ice cream shop where they sell chocolate, strawberry and mint ice creams.



Original question:
How much does it cost for two mint ice creams and a strawberry ice cream with sprinkles?

Goal free question:
With this information, what questions could we answer?

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

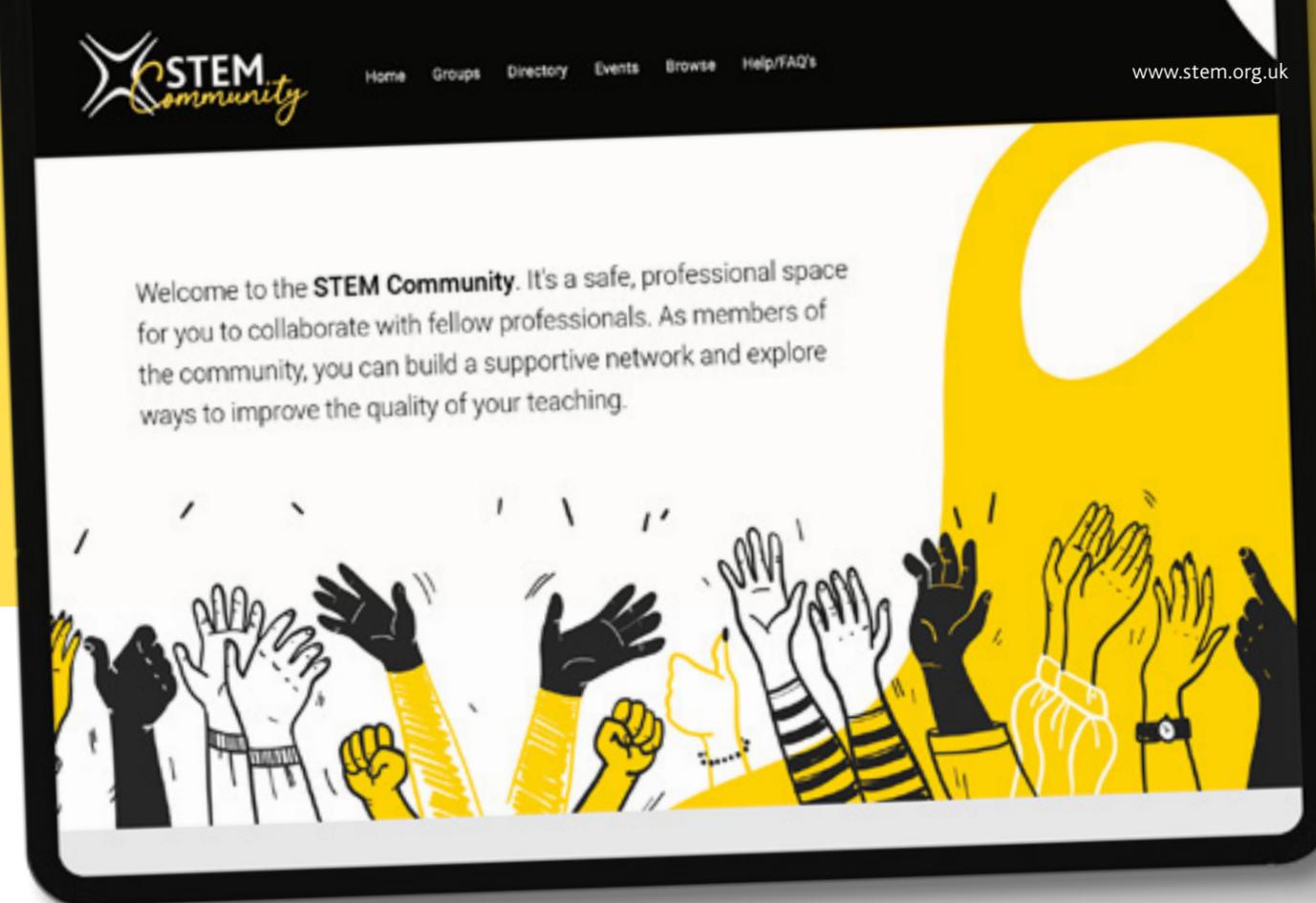
outcomes for young people.

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.



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:

Hello,

I am considering offering my KS2 pupils a short, weekly science club on Google Meet - but I want to make sure I have enough ideas, before committing to it.

I would like to split the session into three short sections:

- a game - eg Explorify Zoom In, Zoom Out, Odd One Out, Science Bingo
- 'Meet' a Scientist - hot seating a puppet as a famous scientist
- a demonstration that the children can then explore after the session - Eg pencils through a bag of water, sinking/ floating demo with fruit (skin on/off)

Any suggestions would be greatly appreciated - especially those with minimal preparation, as I juggle teaching remotely and home schooling my own children!

Best wishes, Helen

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



Starters for STEM

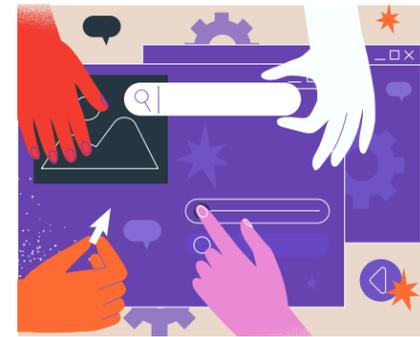
Often, teachers and parents are looking for engaging, hands-on activities that will help to support learning of key skills and knowledge in STEM.

There is a wealth of activities out there but where do you start to look when a simple internet search brings you back over 200,000 results?



The three resources below will help you to deliver exciting, curriculum-linked STEM activities that can be used both in the classroom and sent home for consolidation and engagement.

STARTERS FOR STEM



At the start of the national lockdown in March 2020, our primary team sat down to think about ways we could support teachers and parents with some engaging activities that were easy to explain, required few materials and could be completed mostly by pupils on their own at home.

This was where 'Starters for STEM' was born – a valuable resource bank of engaging one-page STEM activities for parents and teachers to complete at home or as part of a STEM Club.

■ www.stem.org.uk/rxgbad

STARTERS FOR SCIENCE

The success of this resource collection led us to thinking about how we could use this idea to support teachers with more targeted curriculum support – something that could be used for ideas for topics or sent home to support home learning in science. From this, 'Starters for Science' was developed: year group and topic-linked, easy to resource and carry out at home. Like the 'Starters for STEM', the 'Starters for Science' are one-page downloads, plus they include learning from the national curriculum, key vocabulary and activities that will complement school-based work. These will be particularly useful in supporting any learning that may have been missed. They cover all the national curriculum science topics and could be used as school planning tools to ensure coverage of all the topics. We have made every effort to avoid overlapping or repetition of activities.

The 'Starters for Science' also include activities for the Early Years Foundation Stage (EYFS) linked to common themes found in the reception classroom, and can be used as investigation activities within the setting, eg in the EYFS 'Starters for Science', there are activities for exploring what is attracted to a fridge magnet, discovering what floats in the bath and investigating which biscuits are the best for dunking.

In the Year 2 'Starters for Science', there are ideas for pupils to create their own matching animal game, design a new sports kit for their favourite activity – thinking about the chosen materials – and grow a tomato after harvesting seeds from their lunch.

Older pupils could grow salt crystals from kitchen resources, design a boat that will carry the most cargo across the bath and think about the food they could eat if they had the teeth of a hippo or a lion.

■ www.stem.org.uk/cxgmhy

50+ STEM ACTIVITIES FOR ANY PRIMARY CLASSROOM

Our third curated resource collection, which has been pulled together by our STEM Clubs programme team, is '50+ STEM activities for any primary classroom'. Specially created activities that can all be easily carried out by any member of school staff, families, STEM Club leaders and STEM Ambassadors, and in any classroom or home setting, irrespective of STEM subject experience or knowledge.

These resources are helping to broaden the reach of STEM activities, supporting and enriching the curriculum and increasing enjoyment for everyone involved. The primary activities cover such things as: designing a moon rover, how to colonise the moon or even how to launch a rocket mouse. Try testing the theory of flight with paper aeroplanes and helicopters or considering how birds migrate – do size and weight make a difference?

There are so many ideas to explore, and they are all free to download with a STEM Learning account.

■ www.stem.org.uk/rxgqsg



We really hope that you enjoy exploring these resources and find things that will engage the pupils you work with, consolidate the curriculum and help to increase the STEM capital of every family in your school community.

Bring the fascination of Mars into your classroom

Is there life on Mars? This question is one that people have asked for decades, with stories, cartoons, comics, films and games all bringing the idea of aliens and space travel into our popular culture.

The European Space Agency (ESA) might be able to enlighten us, through the findings of its ExoMars mission.

WHAT IS THE EXOMARS MISSION?

The ExoMars mission is a collaboration between ESA and the Russian State Space Corporation, Roscosmos. By working together, the ExoMars mission has already put a spacecraft in orbit around Mars – the Trace Gas Orbiter.

The second part of the mission, now due to launch in 2022, is sending a high-tech rover, Rosalind Franklin, to Mars to take soil samples. Samples from different areas on the surface and underground will be analysed to try and find evidence that life may once have existed on Mars.

As this topic holds such fascination, it's a wonderful context in which to base learning at primary school. The ExoMars resources are a great place to start.

Develop thinking skills through science

Classroom-ready resources and activities for supporting learning in many topics across science activities are accessible through Explorify's platform and ESERO-UK.

Why not try these ideas?

- start a conversation about what is left after an animal has died, sparking curiosity and debate with a selection of everyday objects
- explore the effects of reduced gravity and plant growth on Mars
- investigate which materials would protect astronauts from the Martian atmosphere
- consider adaptations of extremophile organisms when exploring evolution

Work scientifically

Discuss the characteristics of living things and ask pupils how we could look for evidence of these life processes. For example, we could observe evidence of movement on Earth, but how could this be done when exploring a distant planet? What about other evidence of life we could look for?

Most likely, any life found on Mars will be microscopic, so ask pupils to test samples of 'Martian soil' for the presence of microorganisms and investigate the conditions affecting their growth. Pupils can also compare and test the samples, identifying properties that indicate characteristics of 'Martian soil'. These activities are taken from the resource booklet *Is there anyone out there?* and are perfect for the ExoMars mission.

From finding out about Martian weather and alien life to mechanisms involved in taking samples, these activities provide lots of opportunities for working scientifically.

MARS MISSION

Younger pupils can explore weather and make their own simple instruments to measure wind speed. Older learners can use real data to compare and contrast the climate of Earth and Mars, and then research and prepare a weather report for Mars.



EXPLORE WHERE TO LAND ON MARS

Find a landing site – working in groups of space scientists, pupils consider different possible locations to land the Rosalind Franklin rover on Mars. They look at maps, data and the criteria necessary for the lander to land safely, then decide together which site to choose. Will they choose the actual landing site chosen by the ESA team?

DESIGN AND MAKE YOUR OWN MARS ROVER

Pupils find out about robots like Rosalind Franklin and then design and make their own rover, investigating how to collect different types of samples. They also explore different mechanisms and ways to lift and analyse them on the rover. This activity makes for a great D&T project, which can be carried out over a term in class or in an after-school STEM Club.

The Rosalind Franklin rover was designed and made in the UK. Abbie Hutty was one of the engineers involved in the project. Pupils can work like engineers, finding and solving problems and coming up with suitable design solutions. Who knows, maybe one of your class will end up working in the UK's thriving space industry!

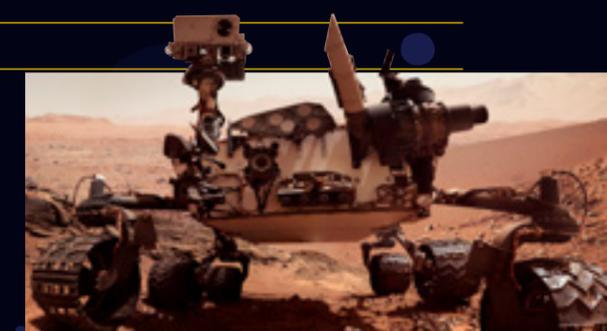
MARS CHALLENGE – CODE A ROVER

The Rosalind Franklin rover will be programmed to explore the Martian landscape. In the Mars Challenge, pupils learn about coding and improve their digital literacy using the context of Mars exploration.

This includes unplugged programming to code the rover to navigate around obstacles and explore different locations on the planet.

TAKE A MARS SAFARI

This resource is designed to leave pupils feeling like they've explored the Red Planet. Working in small groups, pupils design and



build their own ExoMars rover, safely navigate the rover across the surface of Mars and make a solar light that only comes on at night. It contains activities that can be done as standalone sessions or as part of a wider project, learning about the ExoMars rover.

SHARE YOUR EXPLORATION OF MARS

We hope that you enjoy exploring Mars through the ExoMars mission. The enclosed ExoMars poster is for you to share with your pupils to inspire them about space exploration. We hope it will stimulate pupils' thinking about science, design and technology. The poster can also be downloaded from our website: www.stem.org.uk/mag15p-exomars-poster

RESOURCES TO GET YOU TO MARS

EXOMARS COLLECTION

■ www.stem.org.uk/exomars

GO TO MARS WITH EXPLORIFY!

■ explorify.wellcome.ac.uk/exomars

FIND OUT MORE ABOUT EXPLORIFY

■ <https://explorify.wellcome.ac.uk>

Embracing technology in primary schools



2020 saw the biggest shift away from the typical classroom teaching and learning environment in a generation, and it was all managed within a matter of weeks after the initial announcement of a national lockdown. The significant workload increase that resulted in the initial lockdown has continued as teachers adapt to a new normal.

The transformation maintained education for our youngsters through a shift in the approach to teaching, with many primary schools setting project-based work and/or delivering remote lessons. Despite the huge effort, many reports identify the attainment gap between the most disadvantaged pupils and their peers has widened, with some estimates reporting the gap is back to the level of 2011.

One finding, from the Education Policy Institute (October 2020), indicates that there is "strong evidence that disadvantaged pupils received the least amount of home learning" in the initial lockdown, with the difference between disadvantaged pupils and their peers averaging "75 minutes per day". Put into context, this equates to 15 days' less learning for these pupils.

There are three key implications which the Education Endowment Foundation (EEF) identified as a result of school closures.

The first is, as already identified, that the attainment gap has widened significantly. The second is the importance of a sustained and multi-strategy approach for targeted intervention with pupils whose learning has been impacted most significantly. The third is the quality of teaching, especially in respect of the delivery of remote or blended learning. This is best supported through teacher professional development.

Key priorities are those linked to pedagogical approaches that are likely to be effective for disadvantaged pupils, more effective delivery of remote or blended learning, and to support literacy and maths, especially

through subject contexts. At a time when workload is high and when pupils have been out of school for so long, it may seem counter-intuitive for teachers to leave the classroom to attend CPD. However, with the quality of teaching at the forefront of recovery, the short-term implications must be outweighed by the longer-term benefits.

We have developed a series of remotely-delivered, high-impact CPD to complement the existing locally-delivered and intensive residential offer to help teachers to engage with professional development. Our remotely-delivered courses are often available outside of classroom contact hours to enable teachers to engage with the learning without having to sacrifice contact time with pupils. Many courses focus on providing teachers with strategies and tools to support their pedagogical knowledge for remote teaching.

Whatever the medium of teaching, it is important that teachers consider how to transfer what they know about effective teaching from the classroom environment to their remote teaching? The key factors, identified by the EEF in its *Remote Learning Rapid Evidence Assessment*, that support high quality teaching are:

- making sure that pupils receive clear explanation/instruction
- building tasks to enable pupils to be confident in their learning
- applying new knowledge and skills, and building on prior learning
- providing feedback to pupils to include what they need to do to progress

Technology is an important factor to consider when planning remote lessons. Teachers should use a variety of techniques just as they would in classrooms, including project work, to support learning. Some useful ideas of how to use the technology include:

- using concept cartoons and asking pupils to vote on which they think is correct, using a poll. The use of breakout rooms will enable the promotion of talk by pupils. An example using *The Snowman's Coat* concept cartoon could be set up using a platform such as Kahoot
- researching secondary sources, such as apps (see our useful apps link to the right), to complete a project. This will also enable coverage of one of the five enquiry skills from the national curriculum
- recording ideas on a padlet or jamboard about a topic (such as what pupils know about parts of a plant) to create collaborative floor books
- using photos to engage pupils in a particular challenge – for example, finding things that are alive. These photos could be taken by the teacher or by the pupils themselves, and posted to a learning platform

Ofsted, in its COVID-19 response reports, has identified that many primary schools are prioritising reading and mathematics with very few focusing on science. Science is important due to the transferable skills it develops, which will be valuable to pupils in the long term. Some of those transferable skills can be seen in The Royal Society's video, *Why science is for me*. Although focused at secondary pupils, it is clear why these skills are important.

It is expected that Ofsted will return to inspections in the summer term of 2021. It will still be focusing on the broad and balanced curriculum offer that schools are providing, the sequencing of learning, particularly following the period of school closures, and the quality of the teaching and learning that is taking place.

WE ARE HERE TO SUPPORT YOU TO HELP YOUR PUPILS TO MAXIMISE THEIR POTENTIAL

EPI (2020) EDUCATION POLICY RESPONSES ACROSS THE UK TO THE PANDEMIC

■ <https://epi.org.uk/publications-and-research/education-responses-uk-pandemic>

EEF (2020) IMPACT OF SCHOOL CLOSURES ON THE ATTAINMENT GAP: RAPID EVIDENCE ASSESSMENT

■ <https://educationendowmentfoundation.org.uk/eef-support-for-schools/covid-19-resources/best-evidence-on-impact-of-school-closures-on-the-attainment-gap/>

EEF (2020) REMOTE LEARNING: RAPID EVIDENCE ASSESSMENT

■ <https://educationendowmentfoundation.org.uk/covid-19-resources/best-evidence-on-supporting-pupils-to-learn-remotely>

OFSTED (2019) OFSTED COVID-19 SERIES

■ <https://www.gov.uk/government/collections/ofsted-covid-19-series>

SUPPORTING THE WELLBEING OF TEACHERS AND TECHNICIANS

SUPPORTING TEACHER WELLBEING

■ www.stem.org.uk/news-and-views/opinions/supporting-teacher-wellbeing

THE SNOWMAN'S COAT CONCEPT CARTOON

■ www.stem.org.uk/resources/elibrary/resource/366488/concept-cartoons-change-state-and-insulation

ROYAL SOCIETY (2020) WHY SCIENCE IS FOR ME

■ <https://royalsociety.org/topics-policy/education-skills/teacher-resources-and-opportunities/resources-for-teachers/resources-why-science-is-for-me>

USEFUL EDUCATIONAL APPS

■ www.stem.org.uk/sites/default/files/pages/downloads/Science-SmartPhone-Apps.pdf

Support mental health by taking science outside

Following the disruption caused by nationwide school closures due to the 2020 pandemic, Ofsted report that, in addition to regression in learning, many children are also experiencing increased anxiety. Worries about the climate crisis and the future of the planet are likely to be contributing factors to this.

We also know that being outside has positive effects on children's emotional and cognitive functioning. You can support children's mental wellbeing and help them feel empowered to look after the planet by trying these suggestions from four Fellows of the Primary Science Teacher College.



MAKE A MINI WILDLIFE HOME

Using wood, sticks, leaves and other natural materials, the children from Hudson Road Primary School created 'homes' for wildlife in a quiet corner of the playground. The children used hand lenses and identification charts to observe the area over time.

Science Lead and Primary Science Teaching Trust (PSTT) Fellow, Maria McGrory, had noticed that by making these homes and caring for the creatures that come to live there, the children built stronger connections with the natural world.

START A BUCKET SCHOOL

Nicola Bolton, PSTT Fellow and Science Lead at Heswall Primary School, used a Bucket School lesson to support learning about skeletons. This activity provides an effective and creative way to work scientifically outdoors.

Children are given a bucket each, into which they put any resources they need. Once outside, further resources can be collected, and once they start the lesson, their buckets become their seats, creating an instant outdoor classroom.

How to:

- children collect a selection of sticks in their buckets and work in groups to build a model of what they think the skeleton looks like
- explore and discuss pictures and/or models of skeletons before building their stick skeleton again
- draw or photograph the models to show how their ideas have changed. This lesson is great for developing skills of collaboration and persistence and for learning to listen to each other

■ Learn more about Bucket Schools at www.facebook.com/BucketSchool



HUNT THE CATERPILLAR

PSTT Fellow and Science Lead, Elaine Stockdale, at Tongwynlais Primary School, develops children's understanding of how animals survive with a 'Hunt the Caterpillar' team-building game. The game encourages collaboration between classmates and fosters their desire to care for nature.

How to:

- hide a collection of 'caterpillars' (small lengths of pipe cleaner or strips of paper in a range of colours) in different areas of the school grounds
- give the children one minute to work in teams to find as many as possible and then sort them into colour groups. Which colour did they find the most? The least? Why?
- give the children another two minutes to find more caterpillars, followed by a discussion about why some were harder to find, and why colour is important to survival



SUPPORTING RESOURCES

PLAYGROUND SCIENCE - EXPLORATORY SCIENCE ACTIVITIES FOR CHILDREN TO DO OUTSIDE

■ <https://pstt.org.uk/resources/resources-available-through-tts/playground-science>

PSTT WHY AND HOW NEWSLETTER AUTUMN 2020 - INFORMATION AND GUIDANCE ABOUT SUPPORTING CHILDREN WITH ECO-ANXIETY, AND TWO FREE LET'S GO! STEM TRAILS

■ <http://pstt.org.uk/what-we-do/why-how-newsletter>

SPOT THE ENORMOUS CROCODILE ACTIVITY - PART OF PSTT'S 'SCIENCE FUN AT HOME' SERIES

■ https://pstt.org.uk/application/files/6315/9957/5065/17_Science_Fun_at_Home_-_Roald_Dahl_Day.pdf

Ideas for making the most of minimal outdoor spaces

PSTT Fellow, Nathan Williams, is the Science Lead at St Peter-in-Thanet CE Junior School, where he has transformed every available corner of the school grounds into fantastic outdoor learning spaces. While the school is fortunate in having a large outside area, Nathan explains that a lack of outdoor space does not need to be a limiting factor. Here he shares two ideas for schools with minimal outdoor space.

MINI POND



Any watertight container will make a great mini pond, either sunk into the ground or free-standing. The children at St Peter's covered the base of their mini pond with gravel and added some sticks and stones as steps so that wildlife could get in and

out. They used rainwater to fill the pond and added some pondweed. Then, over time, the children observed the pond as wildlife started to investigate and colonise the new space.

Tip: if you have scope to develop the area, rocks and small shrubs (planted in pots if necessary) can provide cover for creatures as they make their way to and from the pond.

MINI ALLOTMENTS



However small, any piece of land not being used is worth considering for turning into a mini allotment. St Peter's developed the space between a metal fence and a kerb where their dustbins used to be collected. The children prepared the ground, chose the

seeds to plant and look after, and recorded their observations and reflections in a nature diary.



Tip: another way to grow plants where space is limited, is to use a vertical or ladder allotment. Its tiered design means the plants on each shelf are equally exposed to sun and rain, and because it leans against a wall or fence, it takes up very little space on the ground.

STEM lift off

The context of space is a great way to engage children with science and technology, as it links to so many aspects of the primary curriculum for all year groups.

Here, Greg Duffy, a teacher at Allestree Woodlands School, shares his experiences of using space-themed projects in the classroom. Allestree Woodlands is a coeducational academy secondary school and sixth form in Derbyshire.

OUTREACH

Through outreach aspects of the ESERO-UK CanSat KS4 competition, we experienced first-hand the dramatic and enthusiastic responses of KS2 (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 award criteria acted as an invaluable guide to focus our efforts on developing in-school Space/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. There is a real sense of pride across the school community for this achievement.

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', which engaged Year 6 pupils during the COVID-19 lockdown and reduced anxiety relating to transition for many children.

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, which works on building and launching model rockets. The Reception-to-19 Space Curriculum development continues this year with expansion to other primary year groups.



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.

PUPIL ENGAGEMENT

This chain-reaction of activities and enthusiasm for Space and other STEM topics amongst our pupils, staff and leadership team, can be directly linked back to the inspirational resources and support we have received through ESERO-UK.

Seeing the real and significant impact on pupil engagement, aspiration and achievement through involvement in STEM projects leads our staff, pupils and school leadership to an inevitable conclusion; we need more space! To the moon!

FIND OUT MORE

SPACE EDUCATION QUALITY MARK

■ www.stem.org.uk/esero/space-education-quality-mark

HOW TO PLAN AND RUN YOUR OWN SPACE WEEK

■ www.stem.org.uk/resources/elibrary/resource/448002/how-plan-and-run-your-own-space-week

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"The course has provided me with lots of inspiring lesson plans and activities that will hopefully engage the students in science."

– Participant feedback, Teaching primary science: exploring space

"It gave me so many ideas about planning and resourcing practical science lessons, increasing my confidence as I applied this to my classroom setting."

– Participant feedback, Teaching primary science: getting started

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