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STEM bulletin

Supporting STEM for all Local Authorities through advice, ideas and inspiration

Adapting to COVID-19

It has been a very challenging 18 months for all involved in education and training, but there is light at the end of the tunnel. The rollout of the COVID-19 vaccination programme combined with the willingness of the majority of the public to adhere to lockdown and associated restrictions means that hopefully, the new academic term will start to resemble some degree of normality.

I have been hugely impressed by how all in education and training have responded positively to the challenges faced due to the pandemic and embraced digital technology to ensure some degree of continuity of learning and support for young people. I am equally proud of how the SSERC team adopted a creative and innovative approach to supporting the education community during the crisis: remote learning, SSERC_TV, SSERC Online Learning self-study courses, return to school COVID-19 guidance and support, sending resource kits to teachers homes to support continued practical professional learning and ensuring that our Young STEM Leader and STEM Ambassador programmes continue to support learners through a range of online opportunities.

It would be easy to concentrate on the negatives associated with the pandemic, but it has driven change that will help shape the new – and better - normal. For SSERC, we have seen increased reach related to digital technology use, and most of our professional learning opportunities were reconfigured to be delivered online.

As an organisation with a reputation for excellence in our hands-on, practical, experiential professional learning, we look forward to seeing the return of delegates to SSERC and supporting more localised face-to-face professional learning. While we see the benefits of adopting a blended approach to professional learning, we will never be persuaded that digital delivery can be an adequate alternative for much of our face-to-face provision, which robustly supports the development of four different kinds of abilities among our colleagues in education: concrete experience, reflective observation, abstract conceptualising and active experimentation; all carried out within an environment that offers opportunities for safe, professional discussion, dialogue and debate and the development of long-lasting professional networks.

It is encouraging that where there is a significant concern with, and criticism of, some organisations that support education, we have been overwhelmed with powerful messages of support from across the education community in Scotland and The UK. We are a small organisation, but we do punch well above our weight, with ongoing and increasing success. We will continue to listen to those that we serve. We will continue to evolve, grow and develop our products and services. In doing so, we continue to be regarded as a one-stop-shop and the “go-to” organisation for STEM education, training and engagement in Scotland (and beyond). <<

Alastair MacGregor

Alastair MacGregor - Chief Executive Officer

Shared sessions in SPARKvue

SPARKvue is Pasco's application for collecting and analysing data from the company's sensors. It is not as powerful as their Capstone software but is free for IOS, Android and Chrome OS. Versions are also available for PC and Mac operating systems, at a cost.

SPARKvue can be downloaded from https://www.pasco.com/downloads/sparkvue as well as from the relevant Apple, Google or Chrome App stores.

SPARKvue can also collect and display data from a device's internal sensors, such as the accelerometers and microphones in a phone or tablet.

Sharing your SPARKvue experiment results with learners remotely

This document and two accompanying videos [1] cover sharing data within SPARKvue to other users. This can be done remotely, over the internet, and all users do not need to be connected to the same network: e.g. the teacher can be in their lab, and all learner users can be in their respective homes. This is a powerful sharing tool that is ideal for use in a remote teaching/ lockdown situation which can be used to share model data and data collection techniques with your class.

1) Collect some data in SPARKvue (or start collecting more data once the shared session is established).

Once data collection is complete tap **Menu** (three horizontal bars top left of screen) then **Shared Session**, see Figure 1. It is also possible to share the data from some sensors live as it is being recorded.

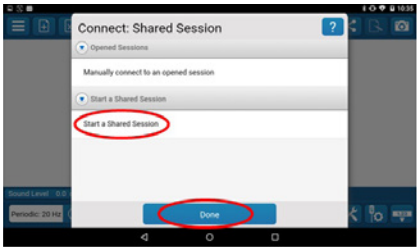


Figure 2

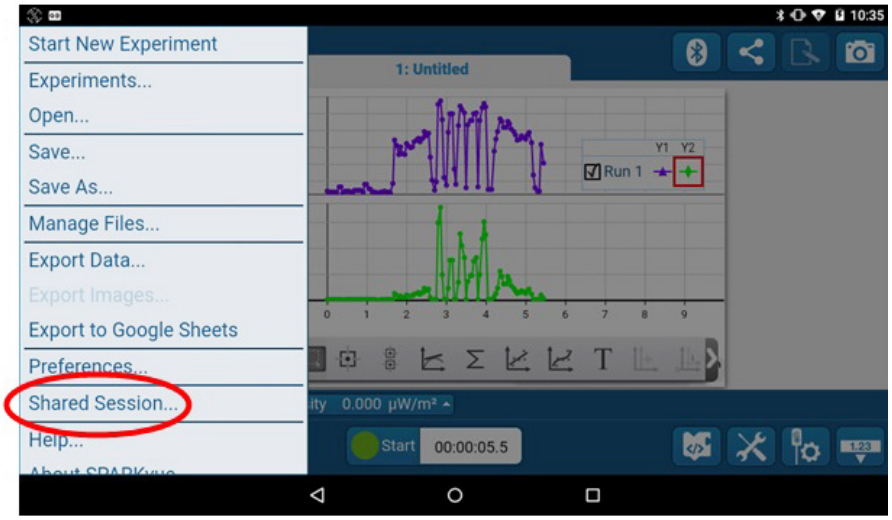


Figure 1 - Tap **Shared Session**.

This will give you two options: to Manually connect to an opened session, or to Start a Shared Session. The option you select will depend on whether you are the teacher, or a learner user.

This next part assumes you are the teacher and wish to share results that you have collected with your learners.

Click **Start a Shared Session** then **Done**, see Figure 2.

Enter your Name then enter the name you wish to give the session (make sure that this is easy for learners to enter), see Figure 3.

You are asked if you'd like to run a guided session: a guided session is where learners can follow what you're doing on their screens, but all buttons are unresponsive to them. This means that they will not be able to change or edit your work until you switch this mode off. An unguided

Figure 3

session is where learners can follow what you're doing, and the buttons on their devices remain active. As soon as they tap their screens, they will log out of your shared session and they can continue independently on their own devices.

In this example we will run a guided session, so ensure this option is labelled as **Yes**.
Leave the Server address and the Port numbers at their default values, then tap **OK**. >>

Once your shared session is established, your screen will have a new panel on the right showing connected users. As learner users connect to your session, you will have the option to approve or block using the green and red icons respectively. There is also an option to **Approve All**, see Figure 4.

Figure 4

Once approved, users are moved into the 'Connected Users' area of the screen, see Figure 5.

Figure 5

To end the session, **press the disconnect icon** then **OK** to confirm, see Figure 6.

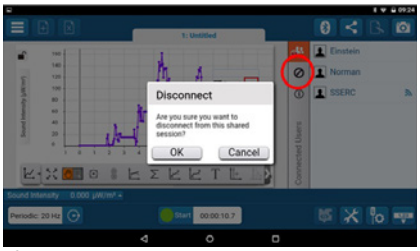


Figure 6

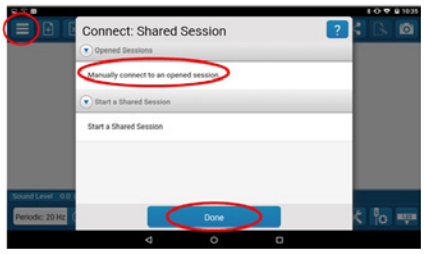


Figure 7

For the learner users, see Figure 7. Instruct them to:

- Open the SPARKvue App. Tap the **Menu**.
- Tap **Manually connect to an opened session** then **Done**.

Type their own name into the name field, see Figure 8.

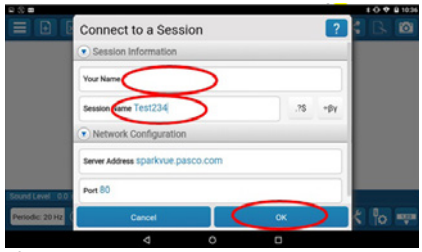


Figure 8

Enter the name of the session, as given by the teacher. In this example, the session name is Test234.

Leave the Server address and the Port numbers at their default values, then tap **OK**.

Whilst awaiting approval to join the session they will see an on-screen notification.

Once you have approved the user they will see a copy of your screen, see Figure 9.


Figure 9

If, at any point, you refer to the graphs it is best to refer to run1, run2 etc. and not to the colour of the trace as the trace colours vary across connected devices.

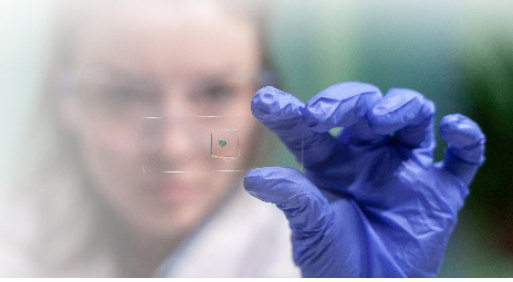
When the user has been disconnected from the shared session they still have their own copy of the data on screen to analyse, see Figure 10. <<


Figure 10

References

[1] We have two how-to videos that accompany this document:
- One from the perspective of the person creating a shared session at https://www.youtube.com/watch?v=MjQ1-MBPLss
- One from the perspective of a learner joining an already created session at https://www.youtube.com/watch?v=7XV5UlrcIjc

SSERC Accredited Centre Programme



Accessing meaningful, relevant professional learning is key to the ongoing professional learning of school technicians and teachers in Scotland. This can be a challenging endeavour, depending upon where you are located in the country. With this in mind, we have established the SSERC Accredited Centre Programme.

Our professional learning courses are developed by a team of experienced practitioners drawn from industry and STEM education. SSERC professional learning courses have all been credit and levelled, by SQA, benchmarked against the Scottish Credit and Qualifications Framework (SCQF). SSERC will certificate achievement at the SCQF level and credit associated with each course.

SSERC Accredited Centres are educational locations across Scotland where you can access many of the same SCQF credit and levelled SSERC courses that you would do at our HQ in Dunfermline. Our main aim is to remove geographical restrictions by establishing centres to make it easier for education staff to reach these centres with minimal travel time.

There are currently seven established SSERC Accredited Centres across the country, with further applications in the pipeline.

Many different types of organisations can become a SSERC Accredited Centre, including further education colleges, universities, and Local Authorities. The centre may include a number of training and assessment sites, organisations, or partnerships.

Courses available to centres are:

1) Introductory Chemistry.
2) Chemical Handling.
3) Introductory Physics.
4) Intermediate Physics.
5) Electrical Safety and PAT.
6) Safety in Microbiology.
7) Safe Use of Fixed Workshop Machinery.
8) Safety in Microbiology Refresher.
9) Safe Use of Fixed Workshop Machinery Refresher.
10) Intro to Microscope Use & Repair.
11) Maintenance of Fixed Workshop Machinery.

In accrediting a centre to deliver the above SSERC professional learning courses, we must ensure that the centre meets the following criteria:

- The centre has the staff, resources, and systems necessary to support the delivery of the course, and that it undertakes to use staff and/or associates who have the required competence in the subject matter and assessment procedures;
- There is a single named point of accountability for the quality assurance and management for the assessment of the course;
- The centre can securely store and manage assessment materials;
- The centre has administrative systems in place to track the progress of learners;
- The centre undertakes to enter into a written Center Accreditation agreement with SSERC;
- The centre undertakes to use facilities for assessment purposes that provide access for all learners according to relevant legislation.

These criteria allow us to guarantee that no matter where you attend a SSERC credit and levelled course, it is the same course run to the same high standards you have come to expect.

To find out more about our SSERC Accredited Centre Programme, click here.

SSERC ACCREDITED CENTRE	LOCATION
Forth Valley College	Falkirk
North East Scotland College	Aberdeen
West College Scotland	Greenock
Glasgow Technician Support Service	Glasgow Gaelic School
Inverclyde Council	Notre Dame High School
North Lanarkshire ICT & Technical Services	Caldervale High School
South Ayrshire Council	Belmont Academy

Heating effect of a current - a favourite demonstration

We are writing this article in the hope that, by the time it is published, science teachers are celebrating a return to something approaching normality with respect to practical work. Meaningful practical work that challenges misconceptions, illustrates concepts and provokes discussion is at the core of what we do at SSERC. We think this activity does all of that.

Figure 1 - Warm water in a mug causing thermochromic film to change colour.

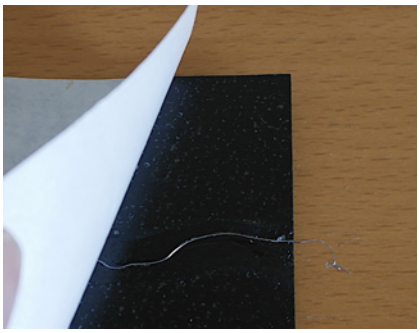


Figure 2 - Resistance wire stuck to the back of thermochromic film.

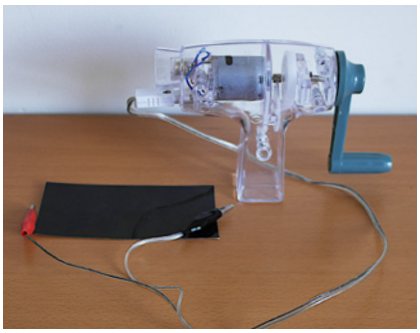


Figure 3 - Hand generator. connected.

This safe, simple activity demonstrates the heating effect of an electric current. As a bonus, it can also be used to promote discussion on the topics of energy conservation and electric vehicles.

Thermochromic film is made from encapsulated liquid crystals that change colour with temperature. The material has been used in forehead thermometers, indicators on electronic components to show overheating, and in battery strength indicators. It is available from the likes of Mindsets [1]. Figure 1 shows a piece of thermochromic film placed against a mug full of warm water.

We use thermochromic film that is sticky-backed. By peeling off the backing it is possible to run a piece of thin resistance wire, nichrome for example, from one side to the other (Figure 2). The wire we used was about 16 cm long and had a resistance of the order of 10 ohms.

We are going to pass a current through this wire. We could use a battery or power supply. If so, we would have to ensure that the wire did not overheat and damage the film. There is less risk of this happening if a hand generator is used (Figure 3). These are available from most suppliers. Power supplies that could be locked to an appropriately low voltage would also be suitable.

Having established with the learners that the film's colour changes with temperature, they can caw the handle. Figure 4 shows the result of generating a current in the resistance wire.

The heating effect is quickly and clearly seen. It is worth noting that:

- The heating is even – one end of the wire is not warmer than the other;
- There is no delay in colour change from one end of the wire to the other.

>>

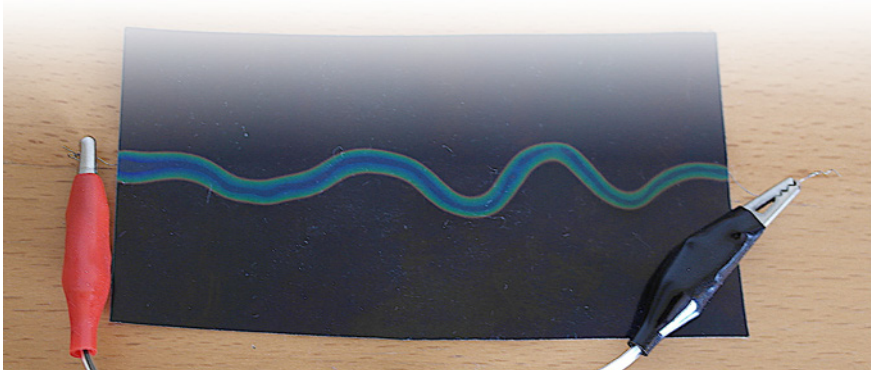


Figure 4 - Current causes heating.

These are important points. Some learners have the image of an electron starting at one side of a circuit and making its way to the other, followed by a band of its siblings. What we are seeing here is more like the motion of links in a bicycle chain. When energy is supplied, charges move together. Learners may also hold the misconception that electrons get 'tired' as they move through the circuit and might therefore expect one end of the film to be warmer than the other due to electrons having less energy at the 'end' of a circuit.

We mentioned a bonus. Compare how difficult it is to turn the generator handle when it is connected to both ends of the wire with the situation where one end is not clipped on. Electrical energy from a generator is not free. It can only be created from another form of energy. Electrified vehicles, like the hybrid car in Figure 5, exploit this.

When you brake in an non-electrified vehicle, the car's kinetic (movement) energy is turned into heat energy through friction heating as brake pads rub against brake discs. The energy is wasted. This also happens in electrified cars, but to a lesser degree. Much of the braking is done using a generator. When you press the brake pedal gently, a circuit connecting a generator to a storage battery is complete. The generator is part of the car's transmission and is linked to the wheels. Just like the hand generator was difficult to turn when it was part of a circuit, the car's generator becomes difficult to turn and slows the car down. Unlike friction braking, some energy is reclaimed and stored in the battery. This energy is available to help propel the car when required.

Figure 5 - Hybrid car.

A less welcome example of generators requiring energy to produce electricity is the bicycle dynamo. A bicycle fitted with a dynamo to power its lights will be harder to pedal when the lights are switched on than when they are not. We also recall a newspaper article many years ago about a man who was using his car to create 'free' energy for his house. He had mounted two large fans on the roof of his car, each linked to a generator wired to batteries in his boot. As he drove, the fans turned, driving the generators which charged the batteries. When he got home, he removed the batteries and used them for house lighting. He would not be told by engineers that the energy he stored in his batteries came at a cost of additional fuel needed to drive a car with greatly increased motion resistance. The extra resistance was of course due to the air having to turn the contraptions on his roof. This could make a great discussion point with learners. What other disadvantages did his system have? Is there any way it could be made efficient – pop-up fans that only generated electricity during braking?

Finally, as an aside, here is a little bit of information on how Toyota's hybrid system works. Feel free to ignore it but you may be surprised at what exactly is going on and it could provide context for some physics topics. Other hybrid systems are in use and don't exactly mirror what Toyota's does.

Toyota hybrids have both an electric motor and a petrol engine. The petrol engines operate on the Atkinson Cycle, a variant of the conventional four stroke cycle. Atkinson Cycle engines are very fuel-efficient but they are low torque, i.e. they produce a low turning force. A car with an Atkinson Cycle engine would be poor at accelerating. An electric motor, on the other hand, produces maximum torque even at very low revolutions. Pairing an electric motor and an Atkinson Cycle petrol engine, where the energy for the electric motor is harvested from braking, leads to an economical vehicle without the drawback of low torque. <<

Reference

[1] https://mindsetsonline.co.uk/shop/thermocolour-sheet/

SSERC professional learning courses

We offer professional learning events for teachers in both the primary and secondary sectors and for school technicians. Many of our events receive funding from the ENTHUSE Bursary scheme or from the Scottish Government. For many courses, bursaries will help towards covering course costs and allow us to provide delegates with resources to support learning and teaching back in their schools. Face-to-face courses will take place at SSERC with appropriate COVID-19 mitigations and social distancing in place.

Courses available for online booking include:

COURSE NAME	RESIDENTIAL?	DATES	CLOSING DATE	SECTOR
Safe Use of Fixed Workshop Machinery (Refresher)	Face-to-face	1 October 2021	3 September 2021	Secondary Technicians
Introductory Physics	Face-to-face	27-28 October 2021	10 September 2021	Secondary Technicians
Wood Turning*	Face-to-face	28-29 October 2021	3 September 2021	Secondary Technology
Safe Use of Fixed Workshop Machinery	Face-to-face	3-4 November 2021	17 September 2021	Secondary Technicians
H&S Online	Online	8, 15, 22 Nov 2021	24 September 2021	Secondary H&S
Maintenance for Fixed Workshop Machinery	Face-to-face	9-11 November 2021	24 September 2021	Secondary Technicians
Safety in Microbiology*	Face-to-face	10-12 November 21	24 September 2021	Secondary Technicians
H&S & Risk Assessment	Face-to-face	16 November 2021	24 September 2021	Secondary H&S
Intermediate Physics	Face-to-face	17-18 November 21	1 October 2021	Secondary Technicians
Hot & Cold Metal*	Face-to-face	18-19 November 21	1 October 2021	Secondary Technology
Working with Radioactive Sources	Face-to-face	23 November 2021	22 October 2021	Secondary H&S
Laboratory Science Nat 5*	Face-to-face	24-26 November 21	22 October 2021	Secondary Science
Safe Use of Fixed Workshop Machinery (Refresher)	Face-to-face	26 November 2021	22 October 2021	Secondary Technicians
Science for Secondary Probationers*	Face-to-face & Online	2 December 2021 2 February 2022	22 October 2021	Secondary Science
Technology Makerspace	Face-to-face	7-8 December 2021	5 November 2021	Secondary Technology
Supporting Advanced Higher Biology*	Face-to-face	7-8 December 2021	5 November 2021	Secondary Biology
Satellite Reception for Beginners	Self-study	17 December 2021	30 September 2021	Secondary Physics
Safe Use of Fixed Workshop Machinery	Face-to-face	26-27 January 2022	29 October 21	Secondary Technicians
Safe Use of Fixed Workshop Machinery (Refresher)	Face-to-face	3 February 2022	30 November 2021	Secondary Technicians
Practical Techniques for Recently Qualified Biologists*	Face-to-face & Online	3 February & 5 May 2022	30 November 2021	Secondary Biology
Wood Turning*	Face-to-face	24-25 February 2022	7 January 2022	Secondary Technology
Chemistry for Advanced Higher*	Face-to-face	24-25 February 2022	7 January 2022	Secondary Chemistry
Working with Radioactive Sources	Online	1 & 8 March 2022	28 January 2022	Secondary H&S
Electrical Safety and PAT Testing	Face-to-face	2-3 March 2022	28 January 2022	Secondary Technicians
Safe Use of Fixed Workshop Machinery	Face-to-face	9-10 March 2022	28 January 2022	Secondary Technicians
Chemical Handling	Face-to-face	9-10 March 2022	28 January 2022	Secondary Technicians
Centre Lathe Turning*	Face-to-face	24-25 March 2022	18 February 2022	Secondary Technology

*This course attracts ENTHUSE funding which offsets the course fee.

Please check our website pages at **https://www.sserc.org.uk/professional-learning/calendar/** for the most up-to-date details on our professional learning calendar. **Courses are subject to change or cancellation due to COVID-19.**

Education Manager of Biology - Dr Annie McRobbie

Attending professional learning events at SSERC, delivered by Kate Andrews with her renowned cool, calm and collected style and a generous splash of humour on the side, has been a highlight of my professional learning as a Biology teacher. My classroom practice, enriched with practical, hands-on learning experiences, is indebted to her mentoring and, of course, the brilliant support of the wider technician team. In June 2021, my appointment as Education Manager of Biology at SSERC took effect and I look forward to continuing SSERC's innovative work, developing, expanding and leading our professional learning offers to support the delivery of practical learning experiences in our schools, colleges and community learning settings.

Figure 1 - Annie McRobbie.

About me

I am a graduate of the University of St Andrews, where I studied Biochemistry and, in typical St Andrews fashion, met my husband. Following graduation, I took a trip over the River Tay to work in the Wellcome Trust School for Life Sciences in Dundee; a place that filled me with unrelenting awe and opened my eyes to another world. I supported work within the Wellcome Centre for Anti-Infectives Research, experimentally determining the biochemistry of parasites involved in neglected tropical disease as part of their wider role in drug discovery. This experience cemented my passion for research and I was successful in securing a 4-year PhD at the University of St Andrews to explore the structure and function of proteins involved in DNA repair mechanisms. Following a brief flirtation with post-doctoral work, I applied to the University of Strathclyde to begin a PDGE in Secondary Education. Over the years, I have been fortunate enough to teach in secondary schools in Falkirk, West Lothian and Stirling, working with outstanding colleagues. My role as an SQA marker at various NQ levels has enriched my understanding of the standards required of our learners.

From the Classroom to SSERC

My passion for practical work in schools has brought me to SSERC. I have established two Teacher Working Groups since my appointment, representing many of the local authority areas around Scotland, to support my understanding of the ever-changing professional learning requirements of teachers at different stages of their career - sampling “delegate voice” is a huge part of what SSERC does to continually improve our offer.

Reflecting on practical work, and my time as a delegate at SSERC, one of my favourite investigations for learners is the colorimetric determination of dehydrogenase activity, using immobilised yeast as a model organism (Figure 2), originally published in a SSERC bulletin in 2016 [1]. This colourful investigation offers the opportunity for varied experiments across a class (so a fantastic assignment topic), with a range of possible independent variables, and can be adapted for use at various curricular levels, by using either a colorimeter to measure the absorbance of the reaction product or by recording qualitative data using a colour-matching chart [2]. >>

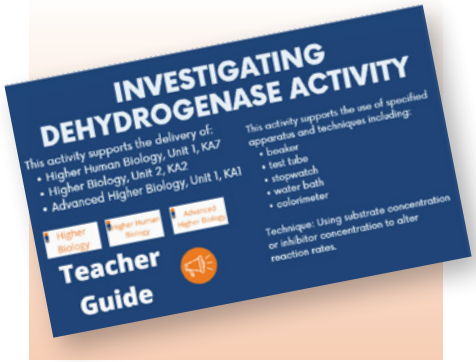


Figure 2 - Teacher Guide for Investigating Dehydrogenase Activity.

Figure 3 - Learner Guide for Investigating Dehydrogenase Activity.

This practical offers the opportunity for learners to develop a wider range of practical skills and the ability to generate quantitative data; a hallmark of an excellent school experiment for me. I have redeveloped this resource, which you can access here, and have put together a Learner Guide (Figure 3) to support learners. I have tailored the pre-existing protocol to the curriculum, focusing on substrate concentration as the independent variable. Throughout the resource, you will find voice clips, images and videos to support your delivery of this investigation, alongside suggestions for wider skill development and DYW links. I welcome any feedback on this style of resource.

As the Education Manager of Biology, I look forward to meeting many of you over the years. Look out for our Environmental Science course in September (Figure 4) and the Advanced Higher Biology courses in October and December. Visit our Professional Learning Calendar to see the full range of offers. <<

Figure 4 - Environmental Science course advert.

References

[1] Andrews, K., Quantifying respiration rate using resazurin. SSERC Bulletin [Internet], 2016 Aug, Issue 256: page 11-12. Available at https://2g1hrx40gw3t1oo1bvqfy70u-wpengine.netdna-ssl.com/wp-content/uploads/2020/08/256-Respiration-using-resazurin.pdf

[2] SSERC, Cell Respiration and Metabolic Rate: Investigating respiration rate in yeast using reduction of resazurin colour chart and using immobilised yeast and colorimeter. Available at https://www.sserc.org.uk/subject-areas/biology/higher-biology/cell-respiration-and-metabolic-rate/

On the bleach

Some years ago, we published details of an experiment [1] to determine the rate and order of a reaction simply using the decolourising of blue food dye by household bleach. Since then, there have been various changes in formulations of food colourings by manufacturers so we thought it worthwhile revisiting what is a useful experiment.

All you need for this experiment is a colorimeter, household thin bleach, and blue food colouring – along with the usual accessories such as cuvettes, pipettes etc.

Colorimeter

Any model will work. One which allows automated readings, by connection to a datalogger for instance, is ideal but not essential. It is desirable to use a wavelength as close to 630 nm as possible but if you cannot get this exact wavelength, don't worry. The value of the rate constant will be a little out, as the molar absorption coefficient is given at 630 nm, but it will be close and the process is still valid.

Bleach

Since the article was first published, the concentration of sodium hypochlorite in thin bleaches has decreased from around 5% to 1%.

Some experimentation may be needed to ensure the reactions takes a suitable length of time.

Contains E133

- Dr. Oetker Extra Strong Blue Food Colouring Gel
- Aldi The Pantry Blue Food Colouring
- Morrisons Cake Decor Blue Colour Gel
- Wilton Royal Blue Food Colouring - Cake Craft Shop
- Lakeland PME 100% Blue Food Colouring
- Hobbycraft Rainbow Dust ProGel Food Colouring*

Contains Spirulina

- Tesco Blue Food Colouring 60 ml
- ASDA Blue Natural Food Colouring
- Morrisons Blue Food Colouring

* This has the red E122 as well so there may be issues.

Food colouring

This experiment uses Brilliant Blue FCF (E133). While this dye is considered safe, there has been a significant move away from traditional colourants towards 'natural' colours. Fortunately, for the chemist, blue is a particularly difficult colour to source 'naturally'.

Some products use spirulina (an extract from cyanobacteria) and there have been experiments with anthocyanins but it has been tricky to get these to give the right colour in a food-related context. Spirulina, for instance can give a good colour but this is not stable on cooking.

This blue will probably be decolourised by bleach but we have not been able to find the molar absorption coefficient so it is unsuitable for this particular activity.

The table above lists some of the common blue food colours – as you can see, the gel forms are all suitable (at time of publication).

Details of the method can be found on the SSERC website [2].

Dilution

We have found at SSERC that a suitable solution is 15 drops of the gel food colour in 100 cm^3 of distilled water. <<

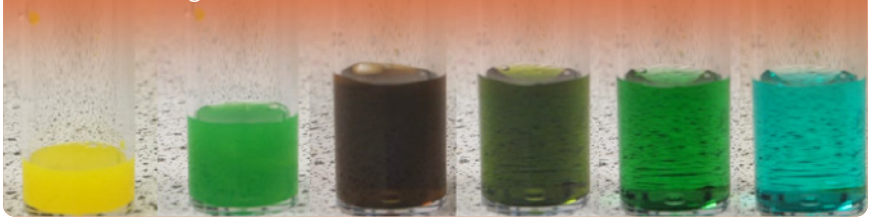
Other related experiments

Other food dyes can be decolourised by bleach too and this can give some interesting results.

For instance, different colours will often be bleached at different rates so if you mix two different dyes (yellow and blue to give green for instance) then adding bleach will cause the yellow of bleach first so the mixture will start off green and go blue before it fades.

Interestingly, most yellow food dyes use cucurmin (from turmeric) and this goes dark red on addition of bleach before it fades due to the alkaline pH of bleach solution.

Below a sequence of photos of this experiment. The bleach has been added at the third image from the left.



References

[1] Bulletin 225, Determining the rate constant and the order of a reaction.

[2] Bleaching blue food dye.

STEM Ambassadors in Scotland

Maths Week Scotland (MWS) is a celebration of the importance of maths in our everyday lives. This year MWS and the STEM Ambassadors in Scotland Hub will have lots of opportunities to get involved. To register to keep up to date on the latest information and to register to receive the resources visit our Maths Week Scotland STEM Ambassador event page.

STEM AMBASSADORS IN SCOTLAND

Maths Week Scotland 27 September - 3 October

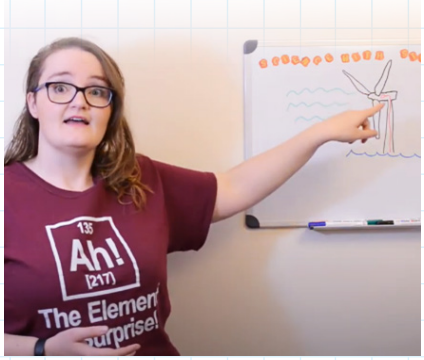
HERE IS A SNEAK PEEK OF WHAT'S IN STORE:

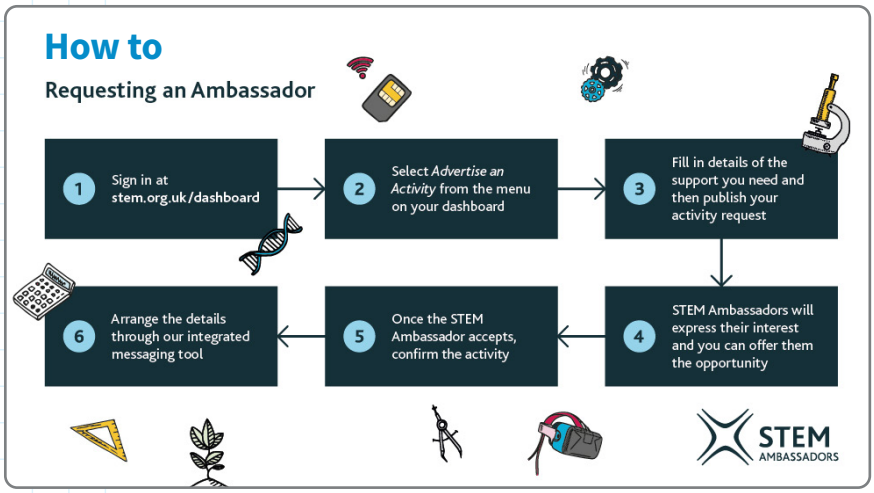
Marvellous Maths

We are bringing back Marvellous Maths! In 2020 we compiled a series of STEM Ambassador led videos focusing on the importance of maths in a range of STEM roles. We will be adding to this collection with more fun and informative videos for you and your learners.

"…But when will I ever use this?"

We're creating a new careers resource for BGE and Senior Phase curriculum based on the maths and numeracy topics that learners find difficult to contextualise. We'll have STEM Ambassadors demonstrate how maths is used in their day-to-day job as well as highlight the different STEM careers available. <<





SAVE THE DATE!

National Coding Week starting 13 September

Schools Information Session - want to find out more about the STEM Ambassador Programme and how you can use it in your school? Come along to one of our short sessions:

- **Wednesday 22 September 16.00-16.45**
  https://www.stemambassadors.scot/event-details/schools-information-session-3

5 activities for Young STEM Leaders to lead in the science classroom

by Pete Colquhoun

The Young STEM Leader Programme is a great opportunity for learners to take the lead in delivering activities, events or interactions that provide engaging experiences for their peers.

Pete Colquhoun - Associate Regional Trainer and Verifier (ARTAV) & Faculty Head of Science at Biggar High School.

If you are looking for some tried-and-tested activities for Young STEM Leaders (YSLs) to lead in the classroom then look no further. Here is a summary of five engaging, enjoyable STEM activities that your YSLs can deliver to complete their STEM leadership hours. I use these resources on a yearly basis as part of our in-house S1 STEM curriculum and our Senior YSLs have had great success in taking on the role of the teacher and leading these activities themselves.

Many of the activities have been sourced from well-known STEM resource websites and then adapted slightly to fit with our own needs.

Lighthouse building

This is an engineering activity which challenges learners to build a working lighthouse using basic equipment found in any classroom (sticky tape, paper, card, straws, foil) and science department (batteries, bulbs, and holders, leads). It works best in groups of 3-5 learners and, as well to teaching engineering principles, the activity develops skills in teamworking, problem solving, forward planning and budgeting. The YSLs can begin by discussing the role of an engineer and the skills involved. Following on from this, the rules of the challenge are explained:

- The lighthouse must stand unassisted with the lightbulb on
- The height is measured from the base of the lighthouse to the lightbulb.
- Only materials included in the list can be used for the structure.

The groups can then plan, design and build their lighthouse using a limited fictional budget. It is recommended that around 2 hours is allocated to carrying out this activity from start to finish.

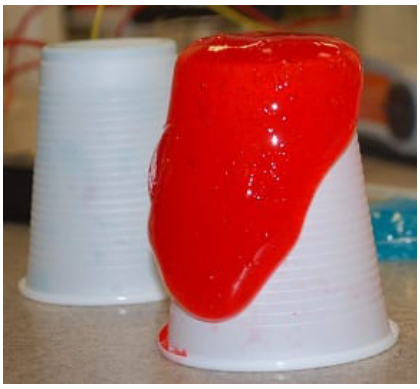
TOP TIP
If possible, ask 2 YSLs to deliver this activity together. Managing the "materials shop" and supporting groups of learners can be quite tricky if they are on their own.

Halloween slime

This science activity is great fun, easy to do, very messy and provides an opportunity for learners to learn the underlying science about why the slime glows in the dark. Only a few ingredients are required to make the slime – PVA glue, water, baking soda, borax solution and glow powder (easily sourced online).

This can be completed quite quickly so a nice follow-up activity if you want to fill a lesson is to use water, food colouring and corn flour to make a non-Newtonian fluid.

The recipes for both can be easily found online [1], [2].



Slime safety

- YSLs and participants should wash their hands after handling slime.
- Slime should not be taken home.
- A few people with sensitive skin my be irritated by the slime – if this is likely, they should wear gloves. >>

Additionally, for glow-in-the-dark slime:

- Only use glow-in-the-dark powder from a known school supplier such as Mindsets [5].
- If the glow-in-the-dark-slime only glows in the presence of UV light, then:
  - use only UVA light;
  - do not look directly at the light source;
  - avoid irradiating the skin;
  - consult SSERC's guidance on optical radiation [6].

No school should have any glow-in the-dark material that is radioactive. If you think you have any, please contact SSERC immediately.

Christmas coding decorations

This festive activity teaches learners to code without a computer, learn about the binary alphabet and create a decoration for their Christmas tree [3].

By first introducing the concept of how computers use a series of 1s and 0s to read letters of the alphabet, the resulting Christmas decoration provides a neat way of visualising this code in the form of coloured pattern. The only supplies your YSLs need to carry out this activity are coloured pony beads and pipe cleaners (you can easily get a supply of these online or at a craft store) and a copy of the binary alphabet sheet.

I'm a Scientist Get Me Out of Here Debate Kits

These free Science Debate Kits [4] are excellent for encouraging learners to engage with major scientific issues, discuss and debate the limitations of science, and consider any ethical issues which can arise from topics that are can otherwise be difficult to introduce in the classroom.

Each kit provides debate cards which provide opinions of fictional characters on a particular topic such as vaccinations, climate change, IVF, self-driving cars and many more. These role-play cards provide the learners with a range of views on the issue at hand and help them to form opinions, discuss different sides of the issue and compare differing points of view.

The user guides are very straightforward, the activity requires very little in the way of resources and each debate can be completed within a lesson. Your YSLs will need to do a bit of reading on the subject matter beforehand but this is provided as part of the resource pack.

I particularly enjoy this activity as it implements literacy and debating skills which are lesson common in science lessons.

TOP TIP
Learners can very quickly become enthusiastic and passionate about debating their views. This can be wonderful to observe but be prepared to step in if things get a little too heated!

Improving gender balance

Produced by Skills Development Scotland, the Institute of Physics (IOP) and Education Scotland, these are a great set of individual lesson resources designed to challenge common stereotypes that exist within STEM. Following the activities, learners should:

- Have a better understanding of the concept of gender stereotyping.
- Be able to give examples of how stereotypes may affect behaviour and attitude.
- Recognise that images in the media are often manipulated.
- Describe themselves in terms of personality traits and interests, rather than appearance.
- Explain the concept of unconscious bias.
- Give examples of how unconscious bias may affect our judgements.

The activity guides are very easy to follow and, in my experience, both the YSLs and lower school learners really benefit from discussing the important issues addressed in these activities.

Pete Colquhoun is an Associate Regional Trainer and Verifier (ARTAV) for the YSLP. You can reach Pete by emailing Pete.Colquhoun@sserc.scot

References

[1] https://littlebinsforlittlehands.com/make-glow-in-the-dark-slime-no-black-light/
[2] https://www.sserc.org.uk/subject-areas/chemistry/chemistry-resources/polymer-slime/
[3] https://littlebinsforlittlehands.com/christmas-coding-activity-stem-ornament-binary-alphabet/
[4] https://debate.imascientist.org.uk/what-is-a-debate-kit/
[5] https://mindsetsonline.co.uk/
[6] https://www.sserc.org.uk/health-safety/physics-health-safety/optical-radiation/ (login required)

Find out more...

To learn more about the Young STEM Leader programme and start delivering it in your school community or youth group, visit **www.youngstemleader.scot**, email us **youngstemleader@sserc.scot** or check out our **@YoungSTEMLeader**.

Hot and bothered

Prep rooms

During the recent spell of hot weather, we have been receiving queries from concerned technicians about high temperatures in their chemical stores. The main problem is usually poor building design, which was addressed in a previous article [1] which includes issues such as the chemical store having no outside wall or the 'make up' air being drawn from a warm prep-room. The longer, hotter and more frequent spells of hot weather that will surely come as a result of climate change suggest the situation will only get worse.

It is worth pointing out that there is no maximum temperature in law for a chemical store – surprising to many people. The legislation covering the storage of chemicals, DSEAR [2] and COSHH [3], addresses the outcomes and leaves the details of how they are achieved up to the organisation.

But high chemical store temperatures are not desirable: it can lead to two main problems from a health and safety perspective.

1) Increased evaporation of flammable substances could give rise to an explosive atmosphere.
2) Increased evaporation of hazardous substances could give rise to an atmosphere that is harmful to breathe.

In both these cases, the issue is excessive vapour in the atmosphere. This can be addressed in two fundamental ways: by reducing the evaporation (reducing the temperature for instance) or by increasing the ventilation. Reducing the temperature is preferable as it will lead to a longer lifespan of chemicals and prevent 'ballooning' of some bottles amongst other things, but realistically, increasing ventilation is usually a significantly easier (and cheaper) way of achieving the same end, at least as far as air quality is concerned.

Doors

On a not entirely unrelated matter, having doors open is generally an excellent way of improving overall ventilation, and this is even more important nowadays as a mitigations against COVID-19.

However, we have had a few queries recently from people who have been told that they should (or at least could) have prep room doors open to improve the ventilation (and provide some cooling). There are some problems with this. First of all, it is quite likely that prep room doors could be fire doors – in which case they cannot be kept open. Even if not, there is a significant problem with security in having the prep room door kept open. Even though the more hazardous materials and equipment are kept securely, there is still plenty of opportunity for a casual 'visitor' to obtain something that could result in a nasty accident.

SSERC strongly recommends that prep room doors should be kept closed. <<

References

[1] Chemical Store Temperatures, **Bulletin 233**.
[2] The Dangerous Substances and Explosive Atmospheres Regulations, 2nd Edition.
[3] The Control of Substances Hazardous to Health Regulations, 6th Edition.

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Managing Editor: Alastair MacGregor Telephone 01383 626070 enquiries@sserc.scot www.sserc.scot