CONTINUOUS PROFESSIONAL DEVELOPMENT
(CPD) FOR SCIENCE TEACHERS

OpenSTEM Africa

LINKING SCIENCE TO EVERYDAY LIFE

Acknowledgements

Ministry of Education

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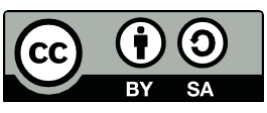
For information on OpenSTEM Africa see: www.open.ac.uk/ido

OPITO for their generous support, which has made OpenSTEM Africa and the development of the Virtual Laboratory and these materials possible.



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OpenSTEM Africa: Ghana

The overarching aim of OpenSTEM Africa, Ghana, is to make a contribution to Government of Ghana/Ministry of Education policy to the effective teaching of practical science.

Effected by:

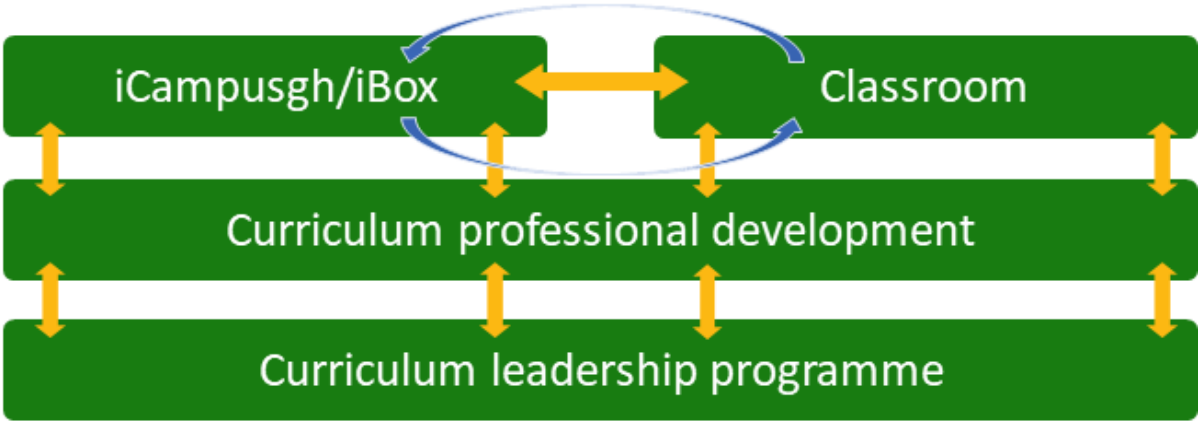
1. **Virtual Lab:** onscreen interactive science instruments using real data and with examples of science lessons, to improve the experiential teaching and learning of science in Senior High Schools, helping develop girls' and boys' practical science study skills, and building on the iCampusgh/iBox model developed by CENDLOS.

Underpinned by:

2. **Continuous Professional Development (CPD) for science teachers:** which develops confidence, skills and strategies to enable improved teaching and learning in the sciences, with a particular focus on ICT-based practical sciences, and which supports them in meeting the aspirations of the SHS elective science curriculum (Physics, Chemistry and Biology).

Embedded in Senior High Schools through:

3. **Curriculum Leadership Programme:** for Heads of Department/Heads of Subject, which enables them to effectively implement short- and long-term strategies to improve teaching and learning in the sciences, with a particular focus on ICT based practical science in their school.



The school-based professional development and leadership programmes will help more teachers use ICT-based science resources more and more effectively, with more learners. The support for school leaders' facilitates the development of a sustainable community of practice in science within the school, led by the Head of Department/Subject Lead and with the support of the Headmaster/Headmistress, in line with National Teaching Council Guidelines.

CPD programme for SHS science teachers

This CPD programme for SHS science teachers is designed by experienced Senior High School science teachers working with Heads of Science and SHS curriculum and Science Resource Centre developers, representing a wide range of Senior High Schools in Ghana. They are working with representatives from the Ministry of Education, from CENDLOS, from the University of Ghana and from The Open University (UK) on OpenSTEM Africa (Ghana).

Improving teaching and learning in the sciences at SHS level is part of the Government of Ghana's *Education Strategic Plan (2018–30)* to enable increasing numbers of SHS students to specialise in the sciences at tertiary level and then move into STEM careers. Government of Ghana policy points to the importance of in-service training for teachers for acquiring new skills and keeping abreast of new developments. The National Teacher Standards for Ghana (MoE/NTC) set out the importance of teachers continuing to learn as they teach and the importance of the school as the location of that learning. Ghanaian research suggests that continuous professional development (CPD) taking place within the school is more motivating, more coherent, more sustainable and likely to be more effective in the long term This is the "growth approach in which teachers are given the opportunity to try new opinions, gain new perspectives, and extend their professional capabilities in order to understand and find solutions to problems in their individual schools" (Asare et al., 2012).

SHS science teachers, particularly those specialising in the elective sciences are already experts in their field. This programme is to enable them to work directly with their Head of Science, or Heads of Physics/Biology/Chemistry alongside their departmental colleagues to further develop the expertise of the whole department in teaching SHS sciences, with a particular focus on ICT-based teaching and learning and to help build a community of practice among science teachers in the school.

Linking science to everyday life

Introduction

Science is all around us. Too often, young people see science as something learnt from a textbook that is not relevant to their everyday lives. Activities like cooking and growing vegetables and mending a bicycle all involve scientific principles. Making connections between the science your students learn in school and the life they live outside school can help to reinforce the scientific principles that your students need to learn to succeed in the SHS elective sciences. It might also help them to understand more about some of the situations that they and their families face in their everyday lives.

Linking science to everyday life is also important in order to encourage more young people, especially girls, to continue to study the sciences. Too often girls, in particular do not see science as relevant to the lives that they expect to lead. You will know that it is a Government of Ghana objective to encourage greater take-up of the elective sciences in Senior High School, and to help a greater proportion of young people to make successful progress through SHS, into tertiary level and into successful careers in science and technology.

In this unit you will work with your Head of Department and your colleagues to devise strategies relevant to your context that you can use to help your students make these connections.

By the end of this unit you will have:

- reminded yourself of how topics in the science syllabuses connect to everyday life
- discussed strategies for further relating science to everyday life, including ways in which using local everyday materials in science teaching will support those links
- identified topical issues related to the science syllabuses that will engage your students
- considered possible topics for project work which link science to everyday life.
- continued to develop your skills in using ICT in teaching and learning, via the final section of this unit.

Reflection point

Think back to what excited and interested you about science when you were growing up. Perhaps it was science ‘experiments’ you might have carried out as a child, or observing the growth of plants or looking at the stars. Consider in what ways, despite all the pressures of teaching science content, it is possible to further develop enthusiasm for the sciences among young people.

Using local resources

National Teachers' Standards for Ghana

The Teacher:

- has secure content knowledge, pedagogical knowledge and pedagogical content knowledge.

(National Teachers' Standards, 2017)

Examples of the Standards in action

- the teacher is creative in their pedagogy, using environments other than the classroom as appropriate, drawing on other adults, nature and the local community.

Everyday materials which can be used in the sciences

As many teachers will know, obtaining chemicals, reagents, and other materials needed to teach the sciences can sometimes be difficult, especially when you would want them in sufficient quantity for the whole class to use them. Many of you will already be expert in utilising everyday materials in your teaching.

Again, as you will know, there are examples to draw on from the elective science syllabuses. For example, in Chemistry SHS 2 Section 3, Unit 1 Alka-Seltzer tablets, other antacids and soluble aspirin are all suggested for the experiments on how temperature affects rates of reaction.

Activity 1 includes two lists compiled by SHS teachers of materials and chemicals which can be used in the elective sciences.

In some cases they have already suggested what kind of experiments and activities these could be used for.

Activity 1: Using everyday materials in your teaching

Look through the two lists below and pick out the everyday materials and chemicals you are already using.

What is it about these materials that makes them particularly helpful in your teaching?

Everyday materials and their uses in the elective sciences

Item	How they could be used
Metal bottle tops	Petri dish, crucible, heating substances, evaporating dish
Plastic water bottles	Funnel, measuring jar, beaker, gas jar, Petri dish, reagent bottle (medicine bottle), conical flask, plant pot
Tins and cans	Calorimeter, beaker, plant pot, heating water, heat transfer experiment, pressure (cooling curve) in liquid (holes in cans)
Newspapers	Insulators, fuel, finding relevant articles, cleaning up spills, problem-solving (e.g. building bridges)
magazines	Use of articles, pictures of habitats, material, pictures of sulphur, diamonds, gold etc.
Plants	Experiments, insulator (dried plant leaves), fuel, proportion of indicators, curve, twigs as stirring rods, spatula, twigs used for density experiments (different sizes of same plant) demonstrating pressure
Leaves	Find area of different leaves, determination of starch in chromatography (extraction of chlorophylls, structures, different leaves, observations of cells under the microscope)
Soil	Testing drainage, pH, filtration, mixture separation, insulator, comparing of soil types
Clothes peg	tongs
Cloth	filter paper/insulation
Bubble wrap	insulation
Tuning fork	sound experiments

Everyday chemicals for use in the elective sciences

- vegetable oil
- vinegar
- gin/ethanol
- lemon juice
- detergent
- lime
- cola
- egg albumen
- tomato juice to clean necklaces
- pieces of different metals (for conductivity experiments)/ electrochemical cells
- potatoes/yams/cassava (demonstration of starch)
- bleach/bathroom cleaners (titration/pH)
- beetroot/red cabbage/hibiscus flowers for indicators
- common salt (effect of impurities in boiling water)
- apples/tomatoes (electrochemical cells).

Activity 2: Using everyday materials in your teaching

Working with your Head of Department/Head of Subject and one or two subject colleagues, choose two or three new materials or chemicals from each of the two lists above – i.e. ones which you are not currently using – and try to think of as many uses you could make of them when teaching your elective science.

- How easily available is each kind of material you have chosen?
- How could you source it? Are there ways of obtaining it inexpensively?

If your HoD is agreeable, create a drawing/poster of these two lists and see how many other materials you can add which are relevant to your subject area.

Talk to colleagues in other subject areas in the science department and see how many more everyday materials can be added to the departmental list.

Learning outside the classroom

The school grounds

There are opportunities across all the SHS elective science syllabuses as well as with the Integrated Science syllabus to make use of the environment outside the classroom. Perhaps the most straightforward opportunity is to use the immediate environment – the school grounds. You may recall that the introduction to the Biology syllabus states:

"For effective teaching and learning in this course, it is recommended that the school should establish a small botanical garden, animals in a cage, fishpond and insects in a cage."

(Teaching Syllabus for Biology SHS1–3, 2010)

If it has been possible to do this in your school and you have a garden, or a fish pond or a compost heap, then you already have environments which will enable your students: to conduct experiments using plants; to consider problems in waste management; to carry out field work to establish, for example, insect populations; and to observe, in terms of scientific enquiry, the behaviour of animals.

Activity 3: Using the school grounds

Work with your HoD/HoS and your departmental colleagues to think of as many ways as you can in which the immediate environment outside the classroom could be used to enhance learning.

- For Biology SHS 2 Section 2 Unit 2, a Teaching and Learning Activity is to use quadrats and traps to estimate the population size and population density of insects or weeds.
- Could pollution (Chemistry SHS 3 Section 1 Unit 3) be explored within your school grounds?
- Could solar energy (Physics SHS2 Section 2 Unit 1) be demonstrated – e.g. through the use of school solar panels?

Be as creative as you can and support your science department to make lists of elective science topics which are relevant to outdoor learning. Then see whether you can integrate such learning within your classes.

Organising a visit

As you will know, in the introduction to the Biology syllabus it states:

> *"Plans must be made for visiting well established experimental and commercial farms, agricultural research institutes and other institutions. Visits must also be planned to scientific and manufacturing organisations, forest and game reserves, man-made lakes, the seashore, hospitals, where students will observe scientific work and the application of science in manufacturing, different types of habitats and interactions in nature.*
>
> *Video clips could also be shown where these are available."*
>
> (Teaching Syllabus for Biology SHS1–3, 2010)

Chemistry SHS 3 Section 1 includes many suggestions for outside visits, including to chemical plants, to mines and to investigate the oil industry. Biology includes field work to investigate soil degradation and the sites of natural resources. Physics SHS2 includes activities for designing solar or wind energy machines and building a biodigester, so field visits to full-scale commercial examples would be highly appropriate.

Activity 4: Organising a visit

Work with your HoD/HoS to gain support for visiting sites outside the school.

- Identify possible sites for a visit. Work as a department group to identify practical protocols for organising trips (risk assessments, permission letters, cost implications, etc.). If there are funding implications, might it be possible for your HoD to approach the SMC, Old Students Association, private companies or the PTA?
- Highlight the importance of planning a visit to support learning – provide evidence from the syllabuses, for example.
- Provide a set of questions to inform planning – what is the purpose of the visit? How will it enhance students' learning of the syllabus? What other benefits will it bring? How can these be maximised?

Visiting speakers

As you will know, an objective of the Ghana's new Education Strategic Plan (MoE, 2018–30) is to encourage more young people to take up STEM careers.

The importance of this is, for example, highlighted in Chemistry SHS1 Section 1 Unit 1, where the various careers are highlighted (Chemist, Biochemist, Teacher Chemist, Geochemist, Pharmacist, Environment Chemist, Phytochemist, Chemical Engineer, Food Scientist, Atmospheric Scientist, Forensic Scientist, Water Quality Analyst) and the Teaching and Learning Activity is for students to "discuss some careers in chemistry and chemistry related fields… and the education and training necessary for these careers". There are, of

course, a similar range of career opportunities for students who would want to specialise in Biology or Physics.

There will also be potential speakers whose background may be more general but who have expertise in one of the topics on the syllabuses, working say in environment management or in health or in technology, etc.

It would also be important, and helpful to your students, if a high proportion of visiting speakers (more than half) could be successful women in science and STEM. You will know that there is a drive to increase the number of girls and young women studying the sciences and STEM subjects and progressing into STEM careers. Women with successful careers in STEM are important role models to everyone in the school.

Making links between science and everyday life

Activity 5: Organise a visiting speaker

Work with your HoD/HoS to organise experts to visit the school to talk to your students.

- consider potential speakers on the basis of their expertise in topics in the elective sciences
- consider potential speakers based on their professional careers
- consider potential speakers based on their links to the school – demonstrating to students the route from your school into a particular science-based career
- remember that organising a visiting speaker needs to include your usual protocols, relevant permissions, invitation letters, etc.
- ensure the visit is organised to maximise the learning (it is important to brief both the speaker and the students beforehand)
- prepare the visit in detail with your students beforehand, discussing the kind of questions that they can ask the speaker and what they would hope to gain from the visit
- ensure that there is follow-up work with the students after the visit, allowing for collective reflection on what was learned and any possible next steps (e.g. if the speaker offers to host a visit for interested students at their place of work).

Every area of the sciences can be linked to everyday practical situations, or to issues that society is concerned about. These can really help students to maintain a strong interest in the sciences, seeing scientific inquiry as the means to address local and national challenges and helping their families and community to improve their lives.

Classroom example 1: Teaching environmental awareness

Mrs Asiaw was teaching her students ways to minimise waste in the environment (Chemistry SHS3 Section 1 Unit 4).

She started by asking what they do with the various waste that is generated in the house. This was obviously an interesting question, because most of the students raised their hands. Mrs Asiaw pointed one by one to several students to give their answers.

- Afua said her father uses the leaves and the waste from the kitchen to make compost for the backyard garden.
- Kwojo also said that old furniture, clothes and shoes were not thrown into the trash but rather were mended and donated to charity.
- Mensah said he uses waste metal cans to make pencil and pen holders, and uses plastic bottles as flower pots.
- Memua added that instead of throwing plastic water bottles into the litter bin, she squeezes them into a smaller size and packs them into a box and sells them to a woman who comes around to buy them for recycling.

Mrs Asiaw went on to ask the following questions:

1. What is waste?
2. What is waste management?

She then divided the class into groups, each with a student leader and set up a 20-minute competition for the students to think of as many waste materials as possible from their homes or communities which could be used in the school.

Activity 6: Making links to everyday life

In a subject group, under the guidance of your HoD/HoS use the syllabuses to make two lists:

- list 1 – topics where a link to everyday life is specifically highlighted
- list 2 – topics that you could make specific links in order to support understanding.

For example, Biology SHS Year 2 Section 4 Unit 4 includes respiration. Relating the principles to students' own bodies could support understanding by measuring heart rates before and after exercise, breathing out into lime water or asking those engaged in and enthusiastic about sport to talk about how they keep their energy levels up. The impact of anaerobic respiration will bring the topic alive.

For example, Physics SHS 3 Section 5 and Section 7 focus on Electromagnetic Induction and Digital Electronics. You could have students design a dynamo to light a bicycle lamp for their bicycles. Or you could have students design a smoke alarm for the laboratory or an electronic switch which puts on a fan only when a light is switched on and two windows are closed for their home or for the classroom.

Think of a topic you are teaching within the next two weeks in which you could make more connection between the topic and students' everyday lives.

Possible strategies

Making science more relevant to everyday life can involve specific references to everyday phenomena (as suggested above) or it can involve adopting specific ways of doing things. For example, in Chemistry in SHS 3 students learn about the chemical industry. They could be asked to:

- write a newspaper article about the impact of a factory on a local area
- role-play an interview in which the interviewee explains how the chemicals from agriculture are causing problems in a local river
- imagine a world without aluminium or iron – what properties would alternative materials need?

All of these activities require students to know about the science covered in the syllabus, but they are also important in helping them to develop support skills such as analysis, evaluation, critical thinking and creativity.

Some strategies might include:

- **Debates** – based on local issues such as waste management or environmental pollution can be highly motivating for students and require them to construct an argument which draws on evidence, including scientific information.
- **Practical work** – use local examples and materials, e.g. hibiscus as an indicator; local insects for work on classification or adaptation; wood and kerosene to compare the calorific content of fuels.
- **Research projects** – students could source information from local newspapers or magazines, interview adults such as visiting speakers or professionals on any of the visits that they make to mines, plants, factories, etc.
- **Brainstorming** – as a class or in smaller groups can help students make connections between the science they learn in class and their everyday lives. There are multiple examples of brainstorming in the teaching and learning activities, where students are invited to draw on their prior knowledge and previous experience.

Classroom example 2: Cooking is scientific activity

Mr Ako Nai Otoo was concerned that some students in his Biology class still considered cookery and food preparation in the home as a domestic activity, unrelated to the outside world and mostly carried out by the female members of the household. While the class were studying Biology SHS3 Section 3 Unit 3 on Biology and the Food Industry, he decided to give homework to encourage all in the class to see food preparation and food preservation in the home as a strictly scientific activity.

- He asked the class to consider local methods of preserving food e.g. drying, salting, smoking (wet hot smoking and dry hot smoking) and to ask their parents, grandparents and other family members for information about preserving fish.
- He made clear that this task would be an individual one for each member of the class – to carry out themselves, and to document the process
- He said that the homework consisted of each individual preserving a fish, using local and family practices of their choosing.
- Each student needed to source a small fish, e.g. a tilapia, decide how to preserve it, and give themselves a maximum of seven days to carry out the process and write up the biological processed involved.
- He told the students they should aim to include photos or videos as part of their documentary evidence.
- At the end of the seven days, each student needed to provide a written report, in which they documented the advantages and the challenges of the method they chose, discussed the biological basis of their method of food preservation and storage, and analysed how their method of food preservation enabled the destruction (or prevented the multiplication) of micro-organisms in the fish.

Happily Mr. Otoo discovered that both the female and the male students in the class benefited from this homework activity. He invited two of the girls and two of the boys to present, making sure that each had chosen a different method. One of the boys presented on dry hot smoking, as this was a speciality in his family and said that his grandparents were pleased with his expertise in smoking fish.

Activity 7: Interactions with nature

Biology SHS2 Section 2 Unit 3 Biological Associations. Find or draw a food web with 8–12 living organisms.

As a class, create a number of scenarios that might impact living organisms, e.g. overhunting/poaching/using a pesticide/fertiliser/decreasing fishing net size/ disease/pollution, etc., and number them on the board.

Have a second list to include:

- increases
- decreases
- disappears.

Person No. 1 chooses a scenario from both lists that links two groups of living things in the web, for example, "*What would happen to the numbers of crabs if the periwinkles were overfished and decreased?"*

Person No. 2 has to explain what will happen back to person 1.

The roles are then reversed. Try to start with closely related organisms and move to more distantly interrelated examples. You could move on to randomly deciding the scenario. Decide on your best example and explain it to the class.

Project work

Project work supports extended analysis and problem-solving skills. It is important in organising project work that you provide a clear brief, making sure the work links directly with the syllabus and making sure students have access to relevant information. Projects are generally designated for group work and group reporting, and so represent opportunities for peer teaching and peer support, and of sharing the tasks involved in the project so that project work does not take up too much classwork or homework time. As always, think about how you choose your groups for projects to maximise the learning within each group and to ensure gender equity with equal numbers of female and male students in any mixed gender group.

There are examples across the elective sciences of possible projects. Chemistry SHS 3 Section 1 on industry and the environment includes many potential ideas for extended project work, focusing for example on chemical plants and chemical production, or mining and mineral extraction, or the oil industry. In Biology, projects could be linked to field work, for example in Biology SHS 2 Section 2 with projects to estimate butterfly populations or weed growth, or exploring soil fertility in the field, or projects on degraded environments or natural resources. And in Physics projects focus mostly on designing and building models, e.g. in Physics SHS2 collecting and storing solar energy, or designing/building a digester, designing a thermocouple, or determining the strength of a magnet.

Designing experiments

In topics across all the elective sciences, it is suggested that students are given the opportunity to design experiments as in the Physics examples given above. This is important, as it links their work in school to what it is like to be a professional scientist. The best way to teach students how to design experiments is to allow them to try for themselves, evaluating their efforts carefully. In real science, things rarely go right at the first attempt!

Even where students do not design their own experiments, they can be taught to critically engage with design principles during any practical activity through questioning:

- Why is it important to do X?
- What alternative equipment could I have used?
- How did I ensure the demonstration was safe?
- What steps did you take you ensure the reliability and validity of your results?

In Chemistry, designing experiments from scratch is demanding, as the practical details are quite technical. A good strategy is to choose experiments which are similar to ones that they already know about.

Titrations – once students know the basics of how to do a titration, they should be able to plan experiments using a variety of reagents (acid/base; redox; precipitation).

In Physics, some design activities could include:

- designing experiments to test the effect of insulation on cooling
- measuring the relative density of a metal
- demonstrating the effect of depth on the pressure of a fluid
- designing and making an electronic device.

All these activities have the advantage of having multiple solutions for an acceptable outcome, giving the activity authenticity.

Using ICT to transform learning

There are simple and inexpensive ways of incorporating ICT in 'science in everyday life' activities. One way may be to encourage your students to take photos of the scientific activity in the everyday lives to illustrate their work. While it is often difficult to allow students to bring phones into school or class, if they can upload photos at home, or send them to you by email or WhatsApp then you can display them on a school PC, or if you have a laptop you can show them to the class, or display them via a projector.

The projects already detailed earlier in the unit, of Chemistry SHS 3 Section 1 on industry for examples gives students the opportunity to research examples of chemical plants on the internet, find video evidence of mining and mineral extraction, or images of the oil industry. In Biology, projects could be linked to field work. And at a more straightforward level, if access to the internet is not always possible, using an Excel spreadsheet for the Biology SHS 2 Section 2 project on estimating butterfly populations or weed growth or the digital calculator on a PC for the Physics SHS2 project for determining the strength of a magnet.

National Teachers' Standards for Ghana

Examples of the Standards in action

All teachers have good technological pedagogical knowledge, knowing how to incorporate ICT into their practice to support learning.

(National Teachers' Standards, 2017)

Lesson planning using ICT

Activities 8, 9 and 10 will help you to think about the effective use of technology and how to make it transformational. Information and communication technology (ICT) provides a great opportunity to make lessons and learning more interactive, and at the same time help students to engage in 21st century skills that are relevant for their studies and future professional lives. Selecting and integrating a range of ICTs in your lesson requires careful consideration and thought.

Activity 8: Using ICT to transform learning

Think of a science topic that you will be teaching next week.

Imagine that you and your students could have access to any technology that you wished.

1. How could you use the technology to support how you would normally teach this topic?
2. How could you use technology to achieve the same learning but in different ways?
3. How could you use technology to provide learning opportunities that would otherwise not be available?

As a subject/departmental group and under the guidance of your Head of Department, collect your ideas for points 1–3 on a flip chart and keep it as a resource to support future planning or to inform the individual coaching sessions you will be having with your HoD.

OpenSTEM Africa Virtual Lab Applications

Practical science

The practical science applications in the OpenSTEM Africa Virtual Lab such as the virtual microscope and the mass spring system being introduced are designed to help you to teach your students practical science in the absence of other reliable equipment.

With each instrument there is an example lesson plan, demonstrating how it might be used to support science learning.

The instruments could be used to:

- introduce a topic
- deliver the main content of a lesson
- consolidate key concepts and ideas
- teach practical skills
- help students solve problems you have posed
- encourage critical thinking
- relate science to everyday life.

Working with your Head of Department, take a look at one of the science apps – the spirometer or electrical circuits or titration, for example – and its related exemplar lessons. Consider:

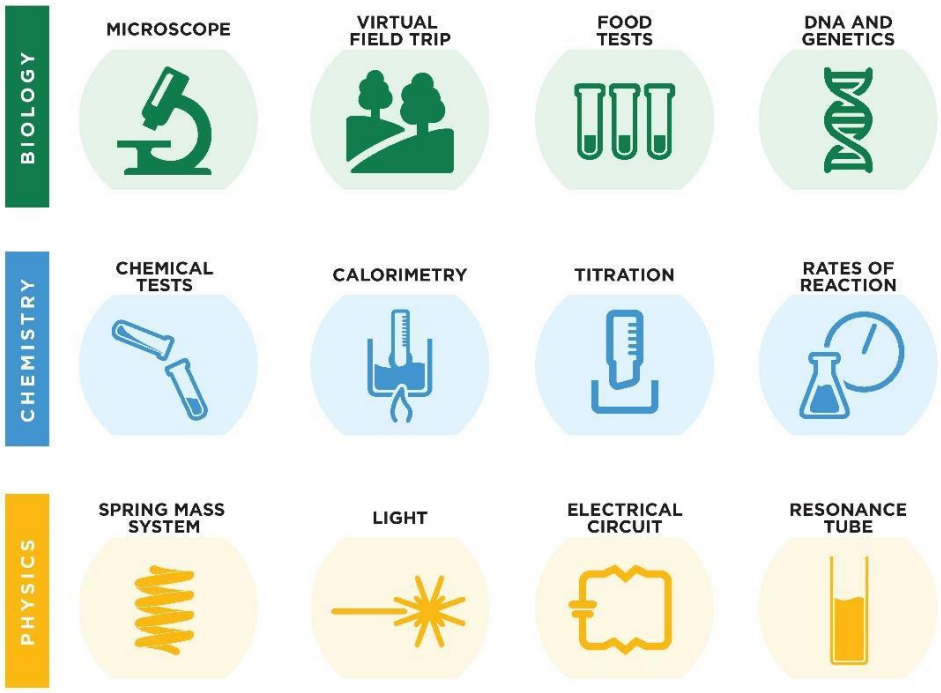
- what practical skills the students will learn
- how the engagement is being used
- alternative ways in which the engagement could be used.

As more apps in the Virtual Lab become available, work with your Head of Department and colleagues to develop more example lesson plans.

Activity 9: Planning to use the Science apps

Work with your HoD to plan activities across the whole department for using the Science apps. For example, you might work with a colleague to choose one of the apps to investigate, work through the exemplar lesson and discuss how it would work best in your school with your students.

OpenSTEM Africa Virtual Lab



The OpenSTEM Science apps have been developed collaboratively by CENDLOS, GES and a group of SHS teachers in Ghana and The Open University. They cover a range of experiments highlighted in the SHS Elective Science syllabuses. Students can interact with the experiment individually at home if the internet is available, or at school if sufficient computers are available. They might benefit more from the experience if they work in twos or threes, so they can discuss the issues and work together to solve problems.

With each Science app there is at least one possible exemplar lesson. These are intended to highlight the possibilities for teaching a lesson rather than anything prescriptive. It is expected that at first you might follow the example as suggested, but you could move towards developing your own plans as you become more familiar with the apps. They have all been designed to be relevant at various points in the syllabus, or over a few weeks of work, so that there is extended opportunity for students to interact with the materials.

Lesson planning using the iCampusgh and the iBox

Activity 10: Examples of using the iCampusgh and the iBox

Teachers in Ghana are using the iBox and iCampusgh, which have been developed by CENDLOS, in a number of ways:

1. **Catch up** – students who have missed lessons are able to access the material at home or in the ICT lab and go through what they have missed.
2. Using the **video** lesson interactively – the teacher plays the video lesson to the class but stops the video periodically to ask questions or to set up a short discussion between the students about one of the issues raised.
3. **Flipping** – students work though the lesson on iCampusgh at home in advance of the classroom lesson. The teacher then organises a series of activities in groups or pairs designed to probe students' understanding. Through careful questioning, peer-support groups can be established and the teacher can focus on those who need the most help.
4. **Note-taking** – the teacher displays the notes and students work in pairs or groups to convert the notes into alternative formats such as poster, a mind-map or a concept map. While they work the teacher walks around asking questions and checking individuals' understanding.
5. **Teacher absence** – the teacher knows that they will be absent on a particular day so arranges for the class to access the lab and work through a designated lesson.

Classify each of the above as:

1. supporting learning as usual
2. extending learning
3. transforming learning.

Activity 11: The mass spring system

Working with your Head of Department, take a look at the mass spring system and the lesson plan. Consider:

- what practical skills the students will learn
- how the engagement is being used
- alternative ways in which the engagement could be used.

As more apps in the virtual lab become available, work with your Head of Department and colleagues to develop more example lesson plans.

Reflection point

Reflect on some of the things that you have learnt and some of the things that you would like to get better at. You should raise these with your Head of Department, who will be able to help you to think more deeply about your lessons and how they may be further improved step by step.

Summary

In this unit you have considered the ways in which you could use locally available everyday materials in your teaching and learning, and the wider ways in which the sciences can connect to the everyday lives of your students, their families and communities. You have also learnt about the importance of this approach for enabling girls to feel more engaged with science learning and to consider a science or technology-based career.

A full list of the OpenSTEM Africa CPD units can be found at:
https://www.open.edu/openlearncreate/CPD_units

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