EASTER BUSH SCIENCE OUTREACH CENTRE

Get hands-on with real-life science

EpiFarm Researcher Guidance

Learning level	Primary: P5-7; Secondary: S1-3	
Research themes	Epidemiology & infectious diseases The scientific method	Food security Computer modelling
Duration	Primary – 50min; Secondary – double lesson	

EpiFarm overview:

EpiFarm provides a researcher-led introduction to the world of epidemiology (the study of patterns and causes of disease in the population at large) and food security through an animated game hosted on the Scratch platform. Pupils will play the part of an expert epidemiologist called in by a panicked farmer to analyse the spread of an epidemic among the hens on their farm. EpiFarm is designed for use in the classroom, but can be scaled down to a tabletop activity without the associated presentation. **This activity can and should be adapted to your own research interests and themes – get creative!**

Learning objectives:

P5-P7	S1-3
• To understand that microorganisms can cause disease • To describe how infectious and disease causing microorganisms can spread through a population • To use the scientific method to investigate the spread of disease • To understand the impact of disease on our food security	• To understand how host factors can influence the spread of disease • To understand how computer modelling can be used to comprehend disease spread • To use the scientific method to investigate the spread of disease through a population • To understand the impact of disease on our food security and explore strategies for disease prevention

Before the activity:

- Familiarise yourself with the EpiFarm game on the Scratch platform.
- Adapt the activity powerpoint presentation, inserting some information about yourself and your research in the appropriate places.
- Complete the attached template risk assessment and send to the school, the Health & Safety team (ros48@exseed.ed.ac.uk) and the EBSOC team (ebsoc@ed.ac.uk).
- Ask the teacher to create a shortcut to the EpiFarm game on pupils' computers (https://scratch.mit.edu/projects/293232347/).

Activity protocol:

The activity has been split into two separate learning levels for use in upper primary and lower secondary classes. Depending on computer resources available, pupils can be asked to work in pairs or triplets, but should each complete a worksheet.

The simulation starts by asking the player to input 3 variables:

- Number of hens on the farm
- The amount of time hens are exposed to eachother for
- The infectivity of each hen (probability of infection upon contact = infectivity/10)

Pupils can measure:

- The final number of hens infected
- The time until all hens are infected

Pupils should identify a research question, construct a rational hypothesis, and use the simulation to test it. **See the cheatsheet below for a full list of possible experiments.** They can repeat the simulation with different values for their chosen independent variable and examine differences in the outcome.

Primary classes

Exercise	Description	Timing
Introduction	Run through the prepared slides giving a brief warm-up introduction to what epidemiology is. We have used the 'Father of epidemiology' John Snow's identification of the source of a cholera outbreak as an example. Put these concepts into context by discussing your own research and give pupils an idea of how this might relate to the real world by discussing implications for food security.	10min Slides 1-5
The scientific method	Emphasise that scientific questions can be answered by doing an experiment. Ask pupils to use their whiteboards to write down the steps of the scientific method in order, using the word bank provided. Talk through the answer at the end.	5min Slides 6-7
Scratch simulation	Introduce the Scratch simulation. Ask the class to write down the research question and identify a suitable hypothesis, independent, dependent and control variables. Run these variables once as a demonstration.	15min Slides 8-11

	The pupils can run the simulation with different values for the independent variable and write down their results on the worksheets before calculating the mean.	
Graphing	Pupils can chart their results as a line graph of the dependent against the independent variable using the pre-drawn axes on the worksheet. Remind them how to write a chart title and to include the correct units in their axis titles.	10-20min Slide 12
Wrap up	Ask a few groups to present their results and report whether their hypothesis was correct or not. Discuss why or why not this might be the case. Calculate the time given per group to present based on the time remaining for the activity. Pupils can discuss their results with their neighbours if necessary. Take any questions the class might have!	10-20min Slides 13-14

Secondary classes

Exercise	Description	Timing
Introduction	Run through the prepared slides giving a brief warm-up introduction to what epidemiology is. We have used the 'Father of epidemiology' John Snow's identification of the source of a cholera outbreak as an example. Put these concepts into context by discussing your own research and give pupils an idea of how this might relate to the real world by discussing implications for food security. Discuss how host factors might influence the spread of disease. Use your own research if possible, but we have also included some examples in the slides.	10-15min Slides 1-7
The scientific method	Emphasise that scientific questions can be answered by doing an experiment. Ask pupils to use their whiteboards to write down the steps of the scientific method in order, using the word bank provided. Talk through the answer at the end.	5min Slides 8-9
Scratch simulation	Introduce the Scratch simulation. Ask the class to pick a research question and identify a suitable hypothesis, independent, dependent and control variables. Choose a research question at random and run the appropriate experiment on the simulation once as a demonstration. The pupils can run the simulation with different values for the independent variable and write down their results on the worksheets before calculating the mean and standard deviation.	20min Slides 10-14
Graphing	Pupils can chart their results as a line graph of the dependent against the independent variable on graph paper. Ask pupils to add error bars to their graphs to reflect the standard deviation they have calculated.	10min Slide 15

Wrap up	Ask the pupils to present their results and report whether their hypothesis was correct or not. Discuss why or why not this might be the case. Discuss a few disease prevention strategies. Try to make these relevant to the research questions pupils have been investigating. Take any questions the class might have!	10-20min Slides 16-18

Scratch simulation cheatsheet

Research question	Independent variable	Dependent variable	Constants	Example application	Notes
Is there a relationship between the number of hens exposed to a disease and how widely the disease spreads?	Number of hens	Number infected	Infectivity Time exposed	Cattle potentially infected with bovineTB have to be tested before going to market.	To be able to make comparisons, take the proportion of infected animals i.e. number infected/number of animals. This experiment works best with either a short period of time e.g. 5 seconds or a low infectivity e.g. <3 (or both).
Is there a relationship between the number of hens exposed to a disease and how quickly the disease spreads?	Number of hens	Time until all infected	Infectivity Time exposed	Questions of animal housing and disease transmission.	Set the time variable to a large value to avoid truncation. Also, the answer might be surprising as the relationship isn't linear because the contact rate increases as the number of susceptible individuals increase, but of course the number of individuals that need to become infected also increases. If you look at the number of hens/second (i.e. transmission rate) you should see (outcomes may vary due to stochasticity) that it increases as the contact rate increases.
Is the spread of disease affected by the amount of time individuals are exposed to a disease?	Time exposed	Number infected	Infectivity Number of hens	Breeding animals to be more resistant to diseases is a useful way to prevent disease, but not all animals may be resistant; they may simply not have been exposed long enough to become infected.	Works best with infectivity <3.
Does the infectivity of hens affect how widely the disease spreads?	Infectivity	Number infected	Time exposed Number of hens	Individuals who are more infectious than others can be targeted for interventions, e.g. quarantine	Infectivity could be a property of the host or the pathogen or both.
Does the infectivity of hens affect how quickly the disease spreads?	Infectivity	Time until all infected	Time exposed Number of hens	Programmes which target infectious diseases can be ramped up if a certain strain is very infectious, or relaxed if it isn't.	Set the time variable to a large value to avoid truncation.