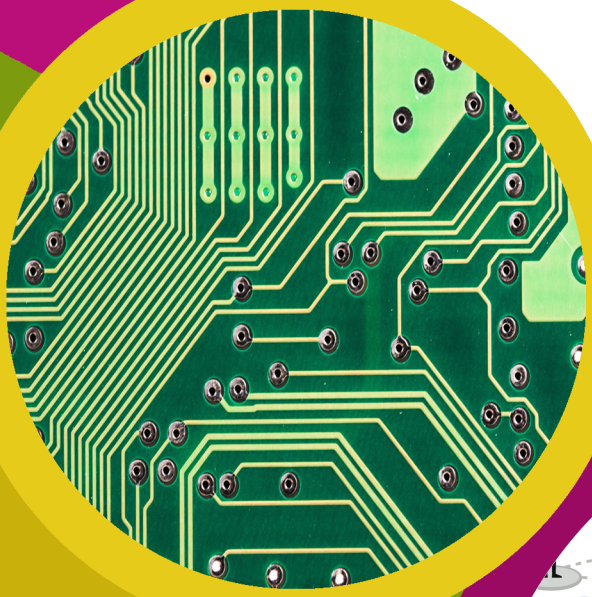
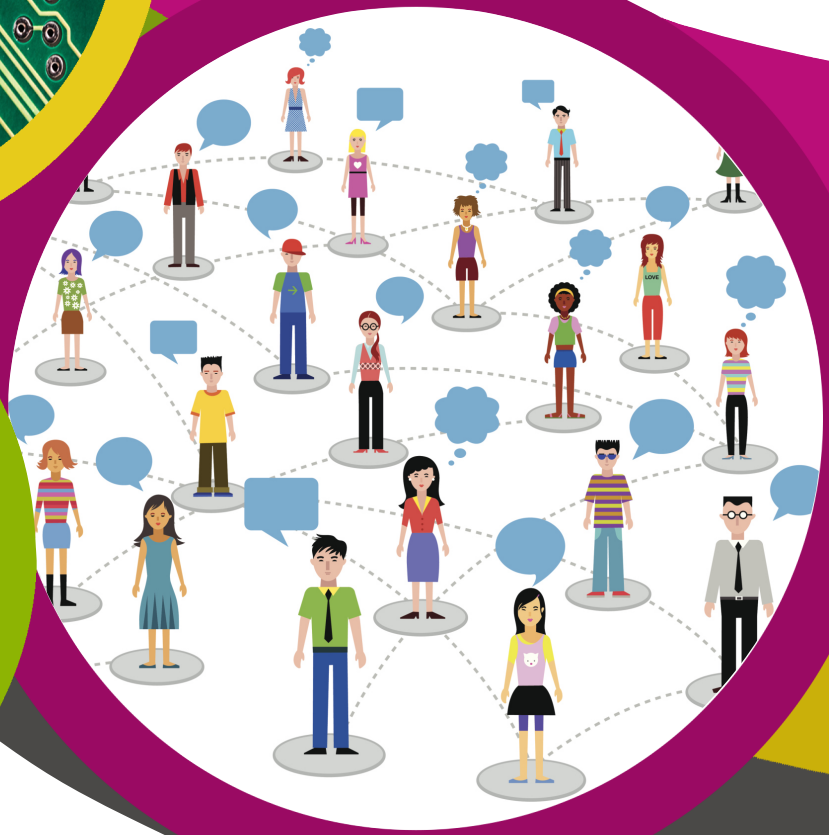
technocamps

Modelling Zombies
Teacher Guidance





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Links to Science and Technology AoLE

Being curious:

(PS3) I can suggest conclusions as a result of carrying out my inquiries.
(PS2) I can recognise patterns from my observations and investigations and can communicate my findings.

Computation:

(PS3) I can use conditional statements to add control and decision-making to algorithms.
(PS3) I can identify repeating patterns and use loops to make my algorithms more concise.
(PS2) I can follow algorithms to determine their purpose and predict outcomes.

Links to Other AoLEs

Humanities:
Human Societies:

(PS2) I have explored some causes and effects of events and changes in my community over time.
(PS2) I am beginning to understand how my community is governed and why there are rules.

The Four Purposes and Cross-Curricular Skills

This resource provides opportunities for **Critical Thinking and Problem -solving** throughout, with learners encouraged to evalutate the models they use and draw conclusions from the results. They are also given the opportunity to be **Creative and Innovate** with their own model, designing the look of their model and improving on their code to add accuracy!

From **Data and Computational Thinking** strand of the **DCF** learners are encouraged to use their **Problem-solving and modelling** skills. Learners are able to recognise and break down problems to predict their outcomes and change the instructions to achieve a different outcome.

Why Is Learning This Important?

This resource allows learners to learn about contagion processes and modelling the spread of contagions (such as a zombie outbreak and the Covid-19 pandemic). This is first done by and intuitively with dice rolls dictating the random spread of the contagion from individual to individual. Learners will then move on to using a proffessional model developed by Swansea and Warwick Universities to investigate the spread of Covid-19 which allows them to alter the starting parameters and see the changes they cause (a worksheet accompanies this task to encourage individual exploration and prediction of outcomes). Finally the learners can develop their understanding of programming their own model in Scratch, before experimenting and exploring how modifying their algorithms can produce unique outputs in a creative way. This links well with **Humaities** and **Health and Well-being** investigating the effects of a pandemic on the individual and society at large.

Session Plan Key

In this session plan we use the following colours to differentiate the types of activities:

- **Yellow - Explain.** Educators should explain the slide/example to the class.
- **Green - Discuss.** Educators should start an open discussion with the class to get them to feedback some answers/ideas.
- **Purple - Activity.** Learners are expected to complete an activity whether it be in their workbooks or on the computer, followed by a discussion of their solutions.
- **Green - Introduction/Conclusion.** The introduction/conclusion is also colour coded green. Teachers should hand out materials in the introduction and conclude the session and collect materials at the end.

Introduction

Begin with introductions, and a brief explanation of the Technocamps programme, before handing out any resources required by learners and any additional aids for learners with additional learning needs.

Explain: Topics Covered Today

We will be learning about Contagion Processes, a topic within Mathematics that tracks the random spread of contagions. We will also investigate professional computer models that use the process before creating our own computer model within Scratch.

Explain: Contagion Processes

A contagion process is a form of modelling the spread of a contagion across a population. The contagion process is run repeatedly in steps for each infected individual. In each step of the process the contagion has a probability of spreading to each of the neighbours of each infected individual.

This repeats continually until the contagion cannot continue to spread. This can happen in many ways:

- all individuals are infected
- all individuals are cured/healthy
- there are no more connections to exhaust between individuals

Activity: Contagion Process

Using dice to provide the random chance, perform the contagion process as a class. Each infected node gets one roll to spread the contagion to one of its neighbours. At the end of each step, either the neighbour is infected or the connection is severed (who wants to be friends with a Zombie?!). This repeats until no viable connections remain.

The class can then attempt this for themselves in groups with the templates provided. After a few turns try altering the probability (what if it's not 50/50, but only 1 in 6 numbers will spread the contagion?).

Ask the class the effect probabilities and the original infected node have on the outcome. Does someone with more friends spread the virus easier?

Discuss: What are Contagion Processes used for?

- What else might contagion processes be used for?
- Why do all these things follow the same principles? (One node effects a neighbouring node, while the behaviour of each node may not be random, the overall behaviour of the system appears random).

Explain: More states

Explain that we can add more states into the system such as vaccination. During each step one node can now be vaccinated against the contagion (again with a random chance of success). This will limit the amount of nodes the contagion is able to spread to,

Activity: Large Contagion Process

Now try the large contagion process with 26 nodes as a class. Include multiple states this time such as vaccination.

- More can be added later if the learners are particularly engaged with this activity.
- Also different probabilities could be tested for different states!

Discuss: Even More States?

- What other states could we add to our Contagion Process?
- How complicated would this model get if we had to do this many dice rolls and still had to keep track of each step?

Explain: Particle People

Explain that because of the complexity of Contagion Processes (and other mathematical models) is why we use computer modelling and simulations. Instead of having to roll each dice individually ourselves a computer is able to perform the same task much quicker and without error.

This model was created in parternership between Swansea and Warwick Universities during the Covid-19 pandemic to model the spread of the virus.

There are different levels of complexity to this model, so be sure to test it out yourself before demonstrating it to the learners.

Activity: Particle People

Have the learners investigate the Particle People model and draw their own conclusions to how different factors effect the spread of the contagion

A worksheet is provided with questions that will guide learners to independently investigate the model and draw conclusions from their results.

Discuss: Government Interventions

How does this model apply to what we saw during the Covid-19 pandemic?

- What interventions did the government implement to stop the spread?
- Do these agree with your findings from this model?

Explain: Scratch

If learners have no experience in using Scratch, then explain the layout of the program, including:

- Different areas - Block pallette, Code, Costumes, Sound, Stage
- Different codes for different sprites and background

Activity: Scratch Modelling

Follow the slides as a class to find the required blocks and assemble them correctly. Give learners the opportunity to explore Scratch, find the blocks themselves and attempt to order them correctly.

Ensure that code is assembled correctly and within the correct sprite.

Discuss: Possible Extensions

Discuss possible extensions to the model. How would this model be improved? What other states could be added? How could the starting conditions be altered?

Learners can then be given the opportunity to explore these changes within their own programs. This can largely extend this activity and greatly improve the quality of learning achieved.

Differentiating for Learners

- The Contagion Process allows for the opportuniy to challenge learners by having them try calculating more states, or to simplify by using a coin instead of dice..
- While using the Particle People simulation some learners may be able to go significantly further in understanding the model and draw strong conclusions, they could even be pushed to attempt drawing conclusions to other viruses. Some learners may require more support to gain a solid understanding of the simplified model.
- It may be of use to provide some learners with the code whilst giving others snippets of code to be assembled. Strong coders could be given the opportunity to try and build the code themselves.

Where To Go Next

- The Scratch model can be pushed significantly further (as shown in the extensions) to build a model comparable to Partice People.
- This activity has given a good foundation in modelling with Scratch, numerous other models can be created with fairly similar code and would be a good way of returning to this work later on. Models such as: The Water Cycle, Migration of People, The Food Chain./Ecosystems..

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