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Using technology (AI) to enhance scientific knowledge, understanding and process skills in primary science schools in England and Wales – positive and challenges

Dr. Amanda McCrory
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What are the current priorities for science education in primary schools?

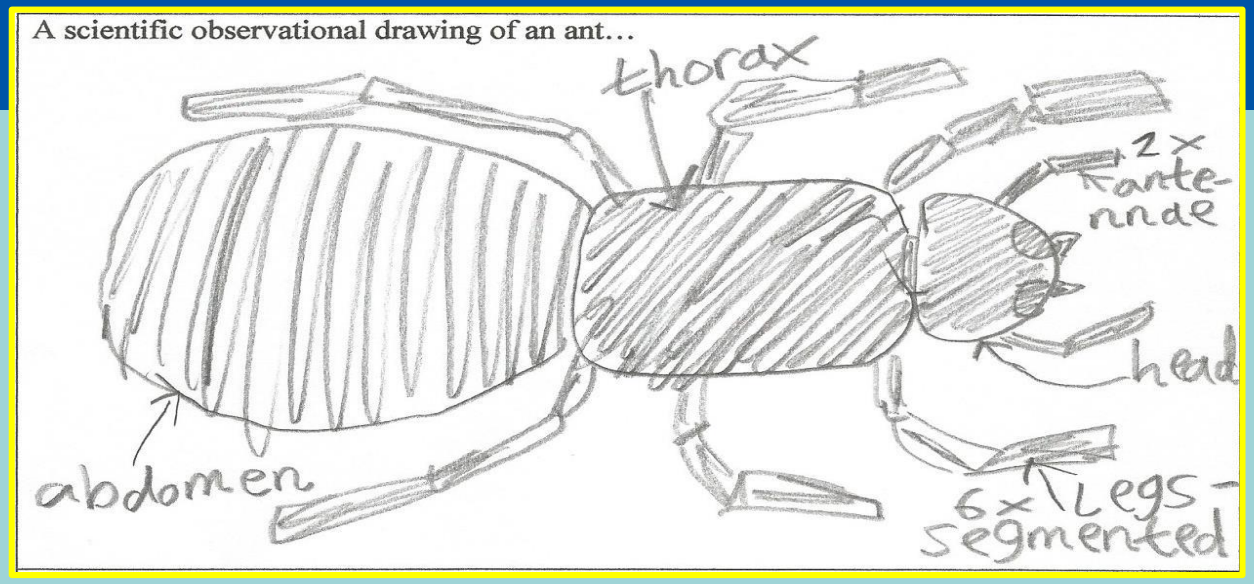
- Department of Education (DfE)
- Office for Standards in Education (Ofsted)
- Scientific communities – The Wellcome Trust, Primary Science Teaching Trust, The Royal Society

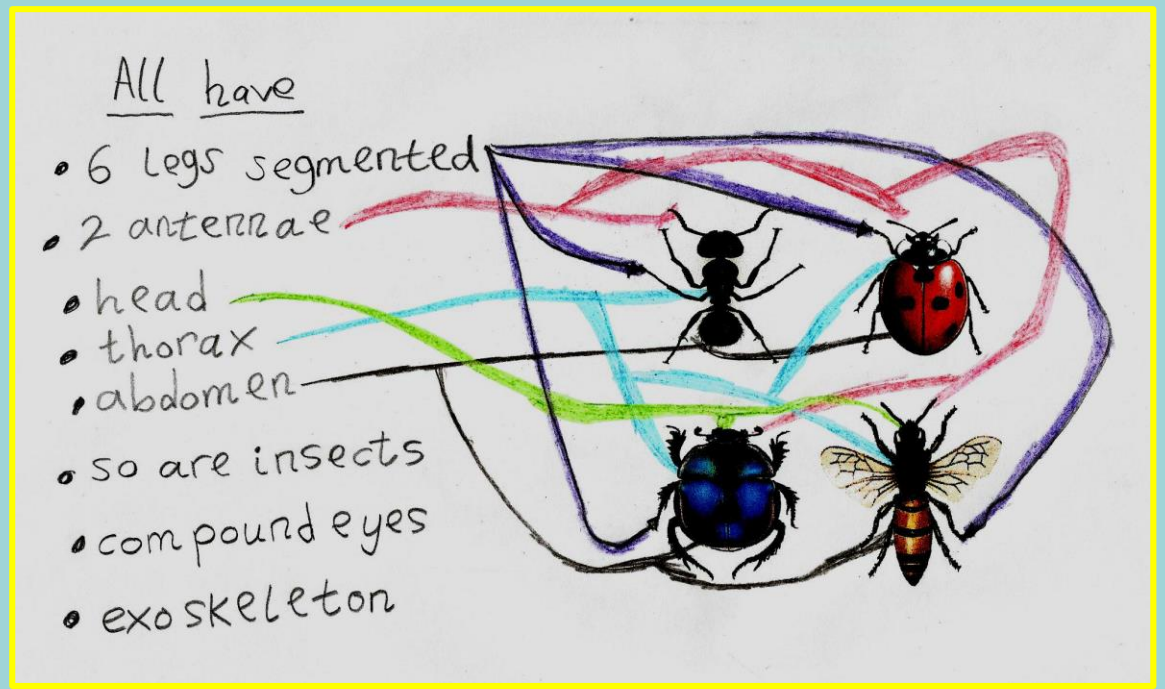
Being scientific involves…

- Focus on the ‘Nature of Science’
- Role of the scientist
- Conceptual understanding of science via biology, chemistry and physics
- Scientific process skills
- Attitudes to science – valuing science
- Scientific literacy
- Understanding that science has changed our lives – impact
- Pedagogical Content Knowledge (PCK, Shulman, 1982)

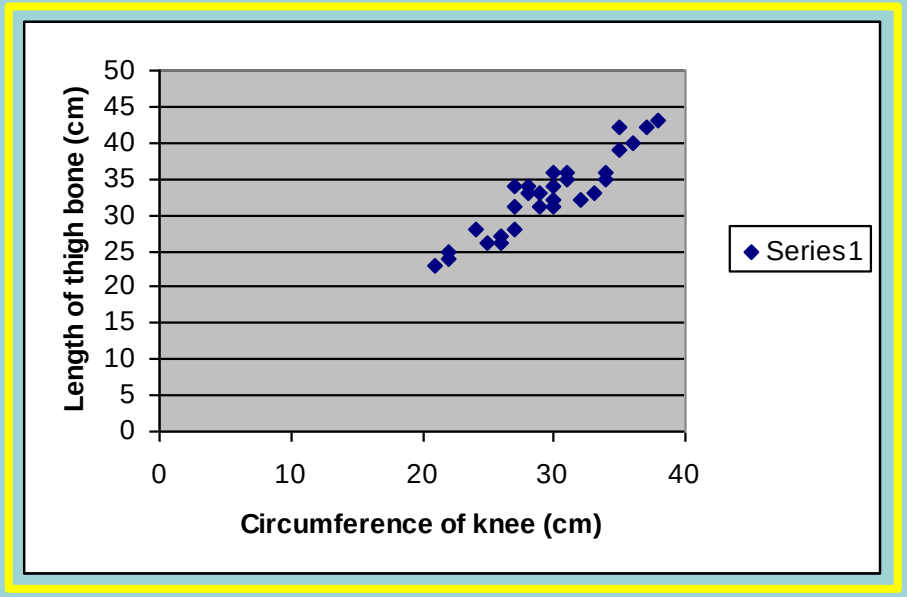
Processes in science include:

- Being curious
- Raising questions
- Making hypotheses - predicting
- Observing / Measuring (using scientific illustrations)
- Evaluating risk
- Investigating – exploring
- Collecting and interpreting data (and evidence)
- Pattern seeking
- Communicating conclusions based on evidence


A scientific observational drawing of an ant…
thorax
2x antennae
head
abdomen
6x Legs - segmented

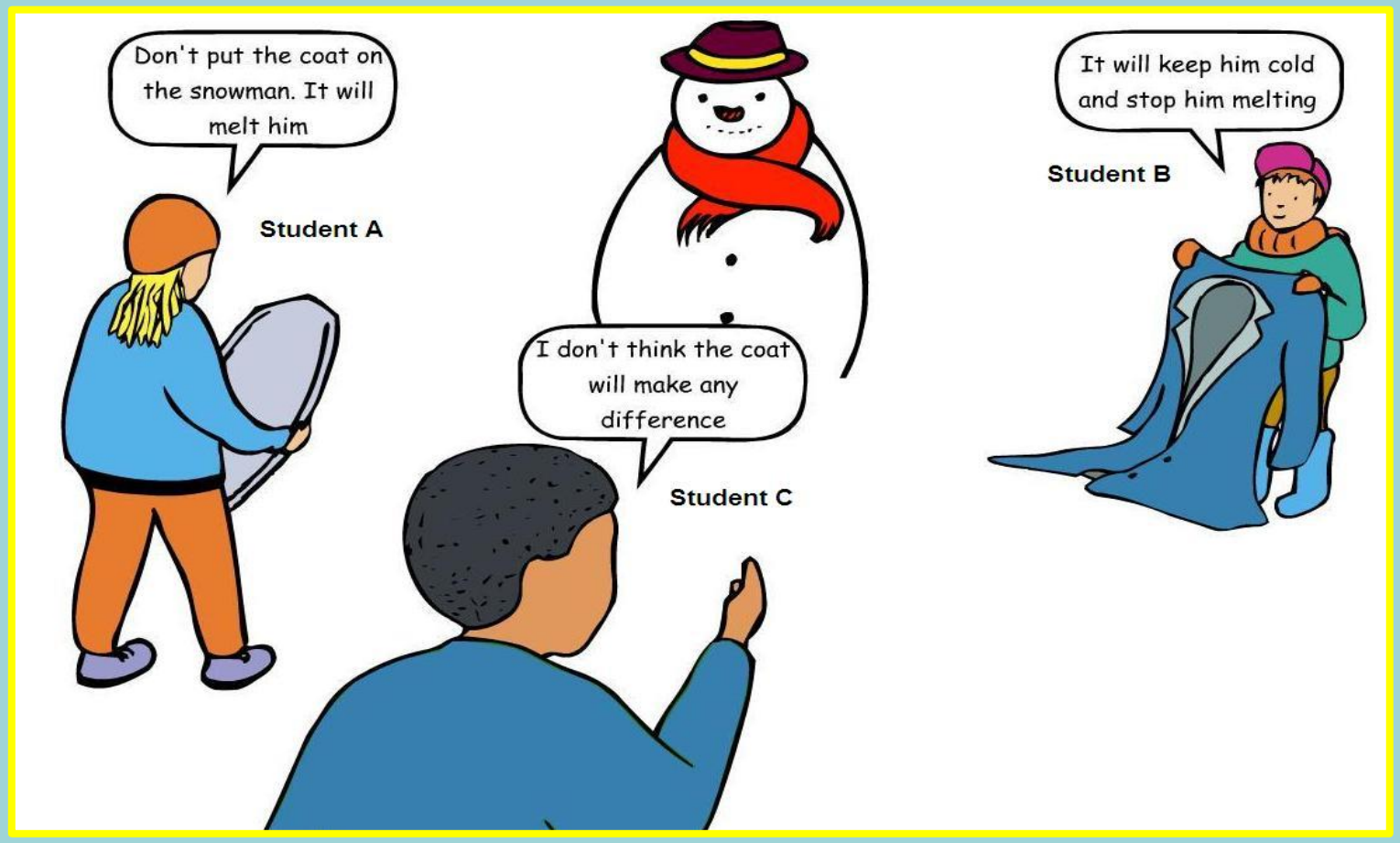

All have
• 6 legs segmented
• 2 antennae
• head
• thorax
• abdomen
• so are insects
• compound eyes
• exoskeleton

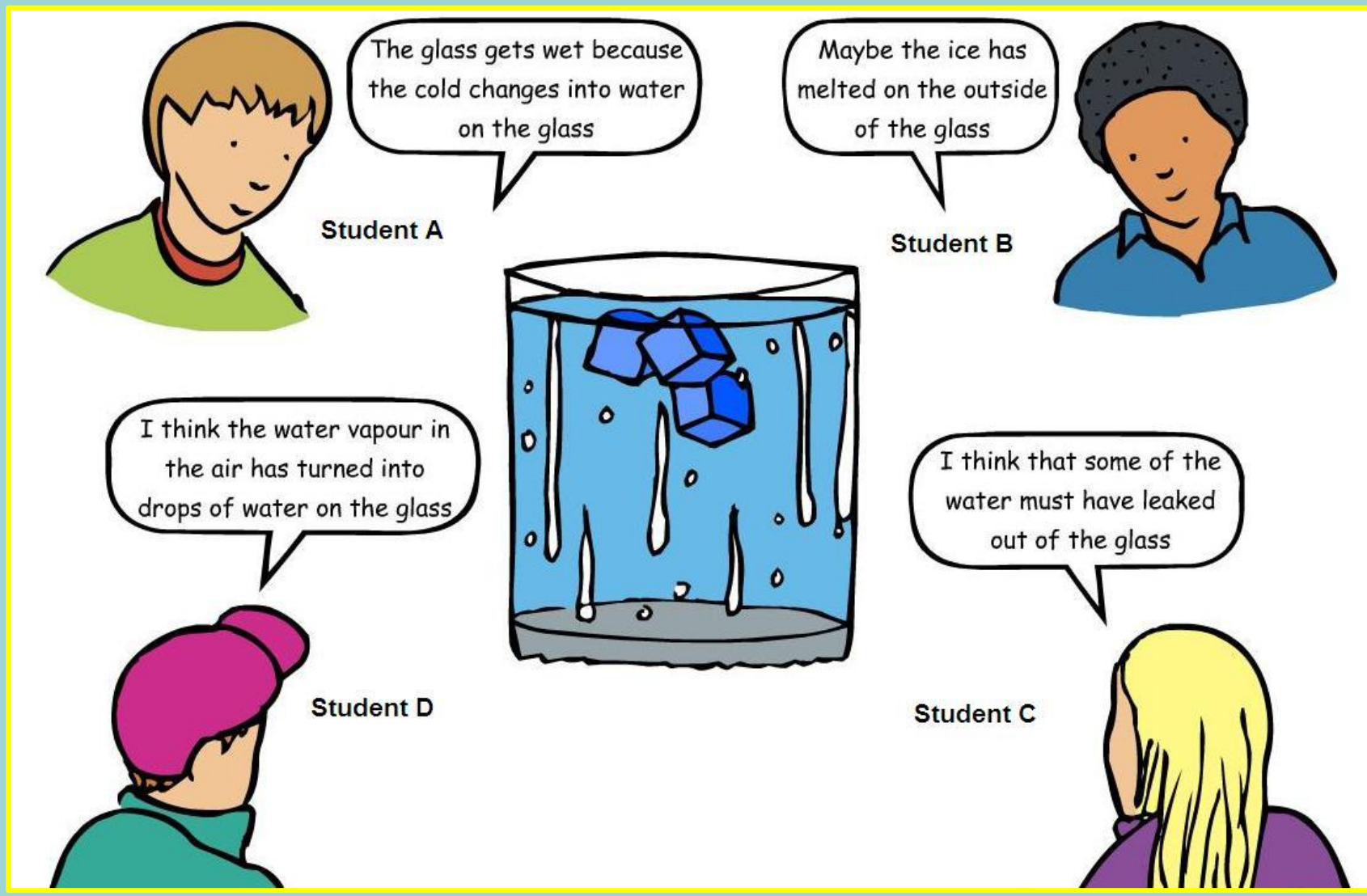

Height of children
Do the tallest children have the biggest feet?
Tall (130 - 139cm)
Medium (120 - 129cm)
Small (110 - 119cm)
10 - 11
12 - 13
1 - 2
Shoe Size


Length of thigh bone (cm)
50
45
40
35
30
25
20
15
10
5
0
0
10
20
30
40
Circumference of knee (cm)
Series1

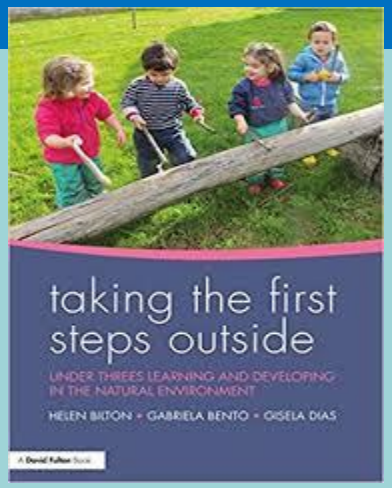

NIAGARA FALLS
RAIN
WATER
ICE
SEA
WATER FACTS
WATERFALLS
Science
WATER HOMEWORK
RAIN
WATER

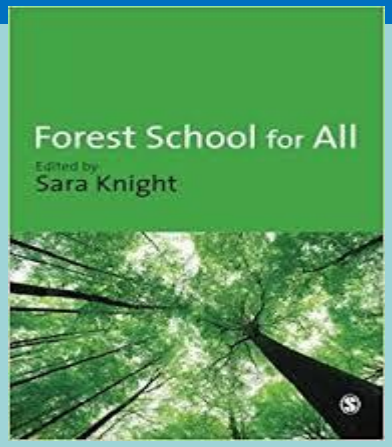

Science
This is a collection of some of our science work. Also noted are our four principle foci. Can you spot them?
SCIENTIFIC KNOWLEDGE
MATHEMATICAL KNOWLEDGE
TECHNICAL TERMINOLOGY
WORKING SCIENTIFICALLY

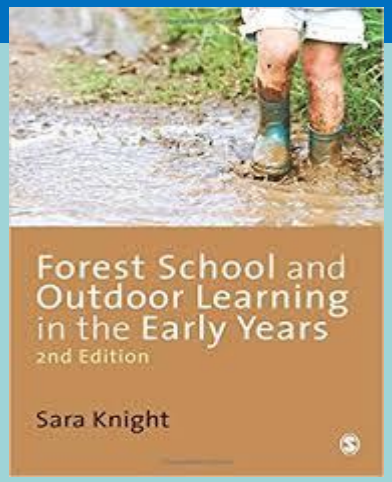

Don't put the coat on the snowman. It will melt him
Student A
I don't think the coat will make any difference
Student C
It will keep him cold and stop him melting
Student B


The glass gets wet because the cold changes into water on the glass
Student A
Maybe the ice has melted on the outside of the glass
Student B
I think the water vapour in the air has turned into drops of water on the glass
Student D
I think that some of the water must have leaked out of the glass
Student C

Science Trails and Forest schools







Bilton, H., Bento, G., Dias, G. (2017) *Taking the First Steps Outside; Under Threes Learning and Developing in the Natural Environment.* David Fulton.

Knight, S. (2016) *Forest School in Practice.* Sage.

Knight, S. (2013) *Forest School and Outdoor Learning in the Early Years.* Sage.

Morgan, J., Franklin, S., and Shallcross, D. E (2016) *Let's Go! Science Trails: A Holistic Way of Looking at Science in the World Around Us Using the Local Environment.* PSTT.

Scientific enquiry – pedagogical priorities

- Children make at least some decisions about how to carry out their enquiry – child-led, build skills via constructivism
- Children talk and think about what their results tell them – linking conceptual science to enquiry (Abrahams, I. and Reiss: 2012, 2014)
- Teachers hand over responsibility for some aspects of enquiry to the children
- Teachers create a **purpose** for children's enquiries
- Teachers suspend judgement about children's ideas – children's ideas are valued – misconceptions are addressed
- Teachers locate enquiries in a broader scientific context to create a bigger picture

How is technology shaping learning of science in primary schools in England and Wales?

- Ipad – Apps : Sea Life; Solar Walk; Sid the science kid!
- Internet – research skills, evaluating evidence – enhancing analytical skills
- Coding – drones, Scratch
- Classroom blogging – authentic audiences
- Multi-media digital books (sound bites, images and videos into digital text)
- Adaptive learning platforms
- Gaming platforms
- Virtual reality

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App – Earth Day Carol
Zippy Brain Inc

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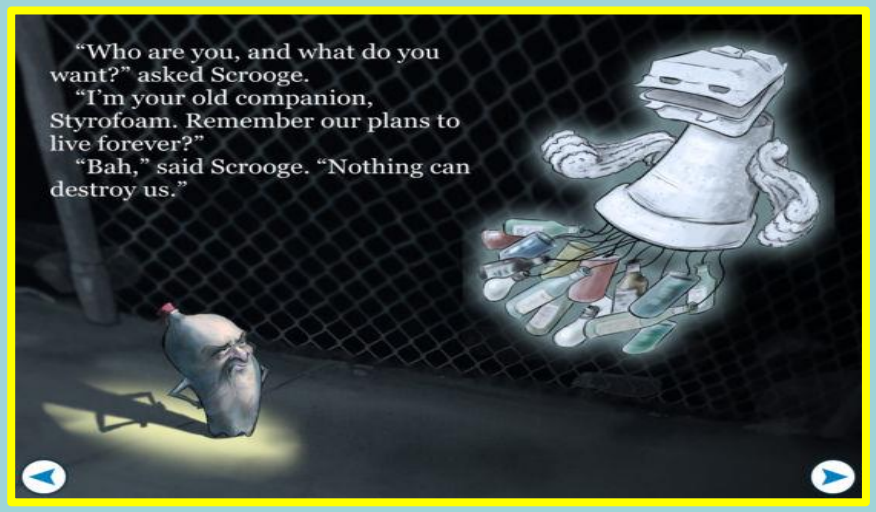

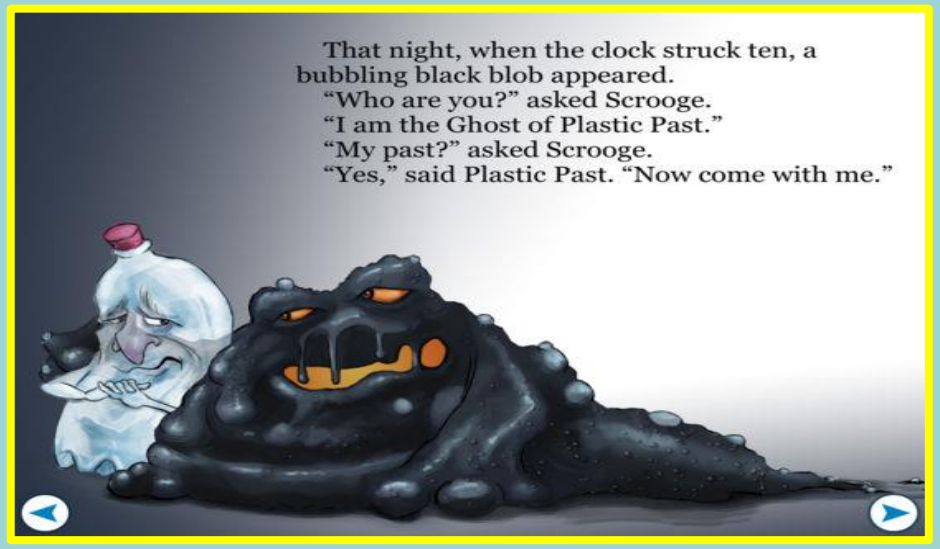

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Exoplanet

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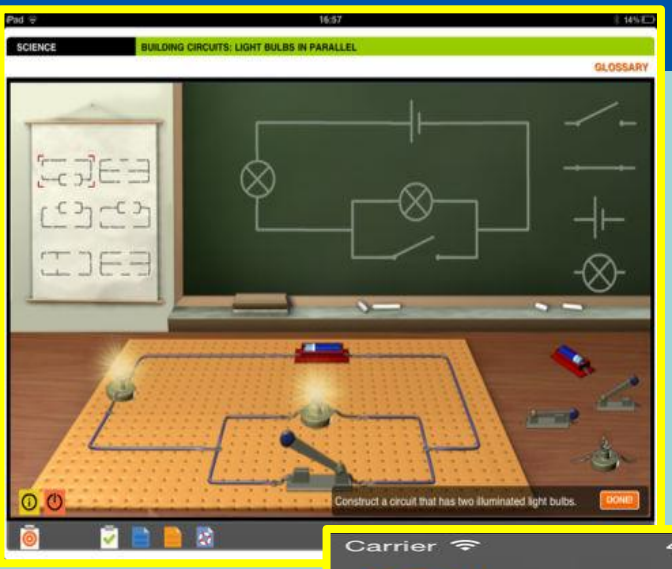

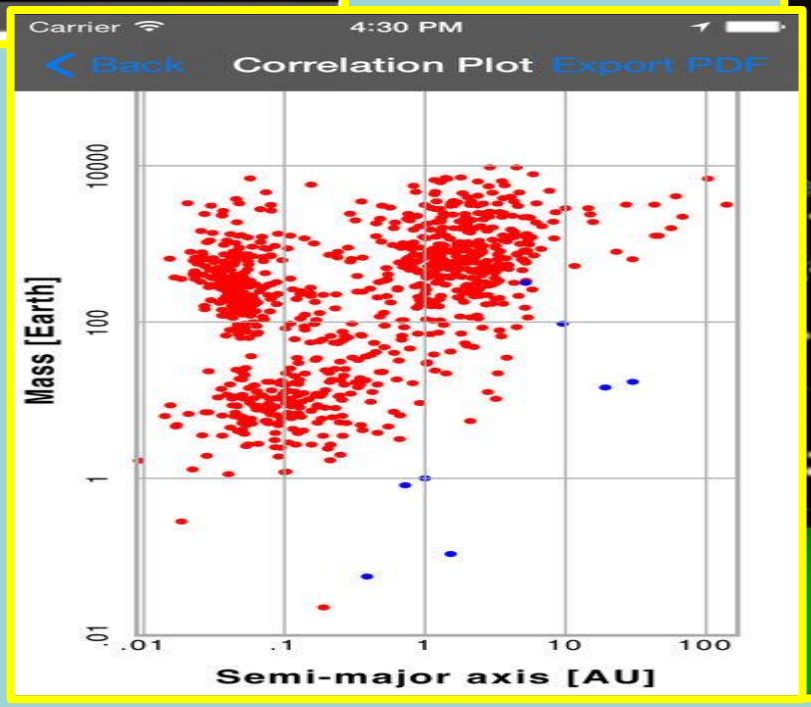

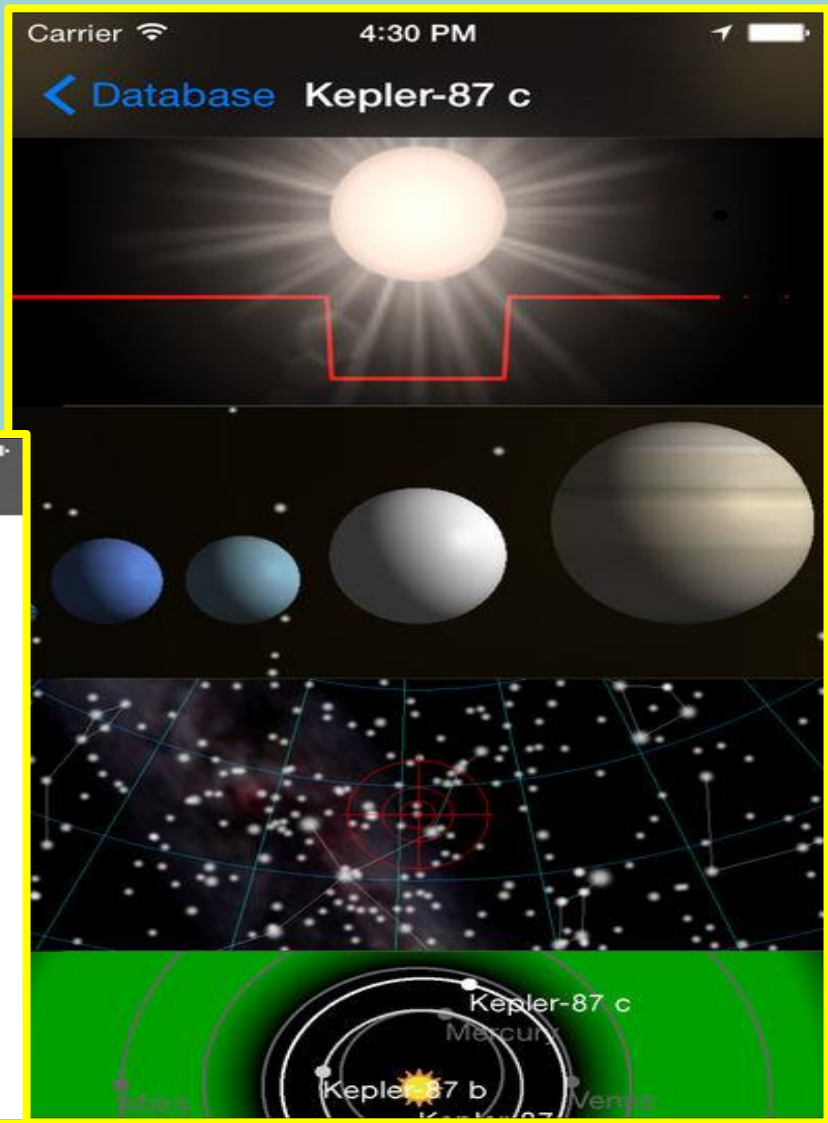

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Blogging – Jake's Bones

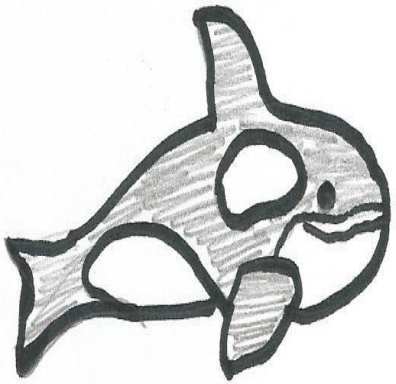
AI in the primary science classroom?

- Infancy
- Artificial reality tools – Google Expedition
- Intelligent tutoring systems - mastery
- Algorithms - grading
- Smart content creation – such as customizable digital interfaces
- Digital curriculum available across devices, incorporating rich media (3D gaming and computer animation)

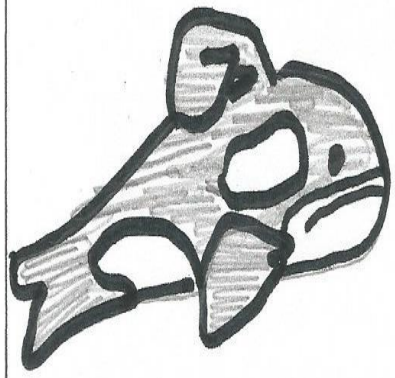
UCL Knowledge Lab - Model-based adaptive systems

- becoming increasingly transparent, allowing educators to understand how a system arrives at a next-step decision
- able to apply a learner model which can include specific conceptual knowledge about science and the students' cognitive needs (feedback)

It is rare for an orca in the wild to have a collapsed dorsal fin, if this is the case, the reason is because the fin has been injured or damaged. In the wild, orca dorsal fins look like this:



In captivity, orcas spend most of their time on the surface of the water – because of gravity, a lack of support from the water, and being fed an unnatural diet, orca dorsal fins look like this:

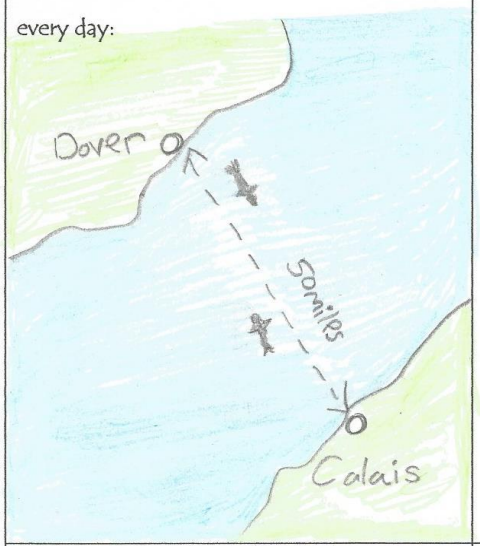


Orcas live longer in the wild!

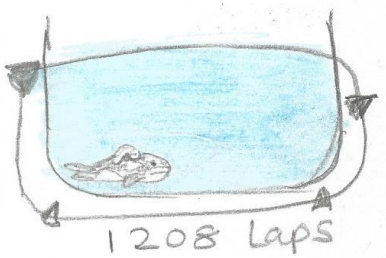
In the wild, average life span for male orcas is 30 (max 50-60 years) ; female 46 (max 80-90 years).

In captivity, the average life span for male orcas is 17 and 27 for females.

In the wild, orcas can swim up to 100 miles every day:



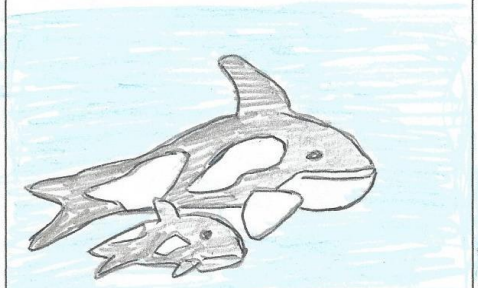
In captivity, orcas are trapped in a tank, they would need to swim 1,208 laps around the tank every day to equal what they would swim in the wild.



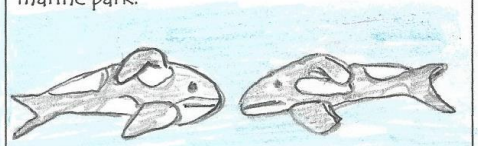
In the wild, there has only every been one reliable report of an orca harming a human.

In captivity, orcas have attacked and killed 3 humans since 1991 and injured many others because of the stress of being derpived a natural life.

In the wild, orcas are highly social animals, living in pods from 2 – 15, calves are raised by the pod . In some pods, calves stay with their mothers for life.



In captivity, orcas are forced to live with orcas from other pods, are moved between facilties for breeding and to perform. Tilikum, was snatched from his mother when he was just 2 years old – taken form his family, he was kept ina holding tank for almost a year before being transferred to a marine park.



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Future use of AI in the primary science classroom – what could investment and a creative approach achieve?

To the student?

To the teacher?

To scientific agency?

To society and the world we live in?

- Intelligent tutoring systems
- Real-time feedback, personal tutoring and assessment
- Virtual human – like characters; work load, extension of the human expert (academic and social competencies)
- Personalised learning- analysis of interaction data
- 1:1 support, mentors for every learner
- 21st century skills – scientific literacy
- Access to global classrooms
- Meeting diverse needs
- Impact on attitudes to science
- Science agency

(Woolf, et. al., 2013)

Thank you for listening and participating!

Dr. Amanda McCrory
Institute of Education, UCL