GRIFFIN SCHOOLS TRUST

OXFORD BROOKES UNIVERSITY

WILLOW BROOK PRIMARY

#PrimaryComputing Curriculum

An Introductory Practical Guide

Presentation to the PGCE and BA PTE cohort

Oxford Brookes School of Education

Wednesday 21 April 2021

COMPUTING AT SCHOOL Lead School

bcs The Chartered Institute for IT

CERTIFIED EDUCATOR

THE ROYAL SOCIETY

Teach Computing

About the speaker

I am the subject lead for Computing at Willow Brook Primary School Academy in Waltham Forest. Since August 2020, I have also been the Community Leader for the Waltham Forest CAS Mixed Community in North East London.

The school I work for is part of the Griffin Schools Multi Academy Trust. The Trust has two other schools in Waltham Forest – Riverley Primary and Lammas School and Sixth Form. The Trust also has a further ten schools, in Kent, the Midlands and Stantonbury International School in Milton Keynes. In my role as subject lead for Computing, since September 2020 I have been tasked with working with three very talented Year 13 Computer Science students who are following the OCR A-Level syllabus at Stantonbury. I completed the NCCE Primary Certificate while #workingfromhome #homeschooling and am currently on the CS Accelerator Programme.

Willow Brook Primary where I am usually based uniquely follows a Secondary model for specialist teachers so I teach Computing from Reception to Year 6. In exchange for having no other class teacher responsibilities, I support the School with an "Intelligent Client" role working with the consultancy which services and maintains the School's hardware and Information Systems as well as being the main contact point for families to support online #hybridlearning

I qualified to teach Primary in 2012 and have worked with every year group. Before becoming a teacher I worked for the Crown Prosecution Service for almost 24 years. During that time, I saw and supported the technological transformation of the workplace from standalone IBM PC XTs to being involved in the "Digital to Desktop" project at the turn of the century with 8,000+ devices installed to over 100 offices via a secure WAN. Going back even further in time, my very first computer was a Commodore Vic-20 and I upgraded to a BBC Micro Model B.

continued…

I have been a member of the Computing at Schools Community since 2016 where I registered after completing the Raspberry Pi Certified Educators workshop. That Summer, I also attended the Raspberry Pi Foundation's Skycademy workshop where the team I was with managed to get its payload to an altitude of over 31,000 kilometres. Willow Brook Primary was recognised as a Computing at Schools Lead School that year. I have been the co-host of a very successful and often over-subscribed Code Club since 2016 where I have regularly used micro:bits with learners as young as Year 5 and Raspberry Pis on a Year 3 project. For 2020, as lead host of the school's CodeClub@home I set up an educator profile with almost 500 accounts on scratch.mit.edu

The Griffin Schools Trust has an excellent Professional Development programme for its staff and in 2017 invited me to be part of its Action Research cohort working towards a Masters in Educational Leadership with Manchester Metropolitan University. I am currently (Autumn 2020) at the dissertation resubmission stage where my project focuses on the notion of "science capital" and specifically on bringing equality of engagement and participation to Computing.

It was through this piece of Action Research that I collaborated with Kano who very kindly provided the Code Club I co-hosted with Kano Computer Kits Complete. I reflected on its success in a poster presentation at the inaugural Computing Education Research Centre hosted by Kings College in June 2018. I've also spoken from the Arena Stage on the opening day at BETT 2019 as well as being a workshop panelist at the Primary Science Teaching Trust 2019 Conference and Educational Leadership, Management and Administration Society (BELMAS) 2019 Conference. For this piece of Action Research, the School I work for was one of the first in London to be a recipient of the Gender Action Initiator Award in December 2019.

Kano were featured in a CNN Business video article in 2019 which was filmed at the school I work for. Kano also very kindly invited me to support their launch of the Kano Windows PC at ISTE in Philadelphia where I spoke to delegates from their stand in the Microsoft Village. In March 2021 I secured a donation of a #VexGo kit which would enable robotics to be easily introduced into the Primary Computing Curriculum. To support my School's Staying Safe Online part of the Computing Curriculum, I have signed the school up to the GoogleUK #BeInternetLegends programme as well as Barefoot Computing's #BeCyberSafe initiative which has been resourced in collaboration with the National Crime Agency.

In terms of my personal vision and direction for computing, I am passionate about raising participation rates for Computing in schools especially among those parts of the community which are under-represented, demonstrating that learners as young as those in Early Years will have some abilities to 'code' and ways of raising the profile of Computing as a subject so that it is valued intrinsically rather than some compliment to other parts of the curriculum as some educational settings seem to have adopted.

Allen Tsui
Twitter: @TsuiAllen
21 April 2021

[Presentation and speaker notes start on the next page]

My Primary Teacher milestones in pictures…

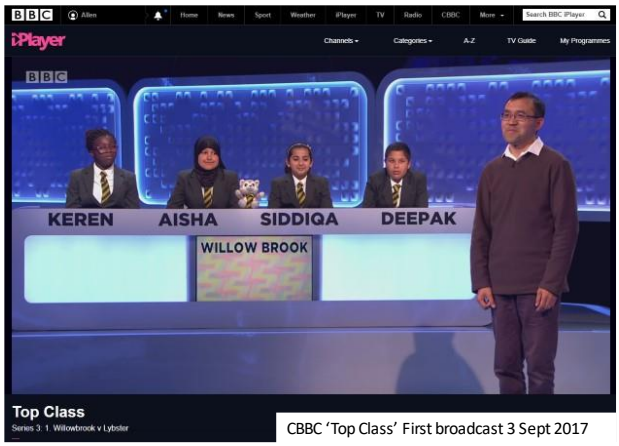
BETT Show, Jan 2019

Channel 5 News, Aug 2019


CNN Business, July 2019


Lords Cricket Ground, July 2017

Barbican, April 2017



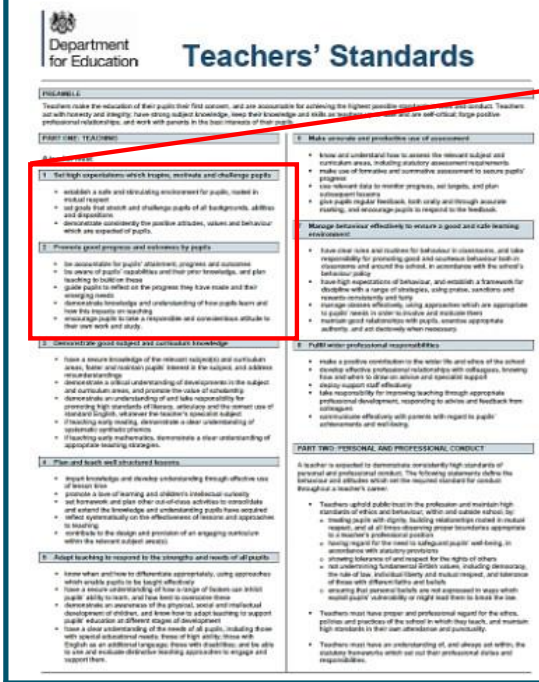
CBBC 'Top Class' First broadcast 3 Sept 2017

ISTE Philadephia , June 2019

Whenever I have the opportunity to reflect on my journey to my present role as subject lead for Computing, I'm never too sure what proportion was by design or unintended circumstance. If I had been told when I left the Civil Service after a career of almost twenty-four years that becoming a Primary School Teacher would mean making three television appearances, become a World Record breaker by playing cricket at Lords, provide backing vocals to an internationally renowned Jazz pianist on stage at the Barbican, share a stage with a Government Minister on the opening day of one of the World's largest Educational Technology Trade Fairs as well as being part of the product launch team exhibiting in the Microsoft Village at a similar event in Philadelphia and be sponsored to study a Masters in Educational Leadership, I would never have believed them. So I'm really pleased and proud to be speaking to you today offering an introductory practical guide to the Primary Computing Curriculum.

[Presentation and speaker notes continue on the next page]

Teachers' Standards Part One: Sections 1 and 2


Department for Education

Teachers' Standards

1 Set high expectations which inspire, motivate and challenge pupils

- establish a safe and stimulating environment for pupils, rooted in mutual respect
- set goals that stretch and challenge pupils of all backgrounds, abilities and dispositions
- demonstrate consistently the positive attitudes, values and behaviour which are expected of pupils.

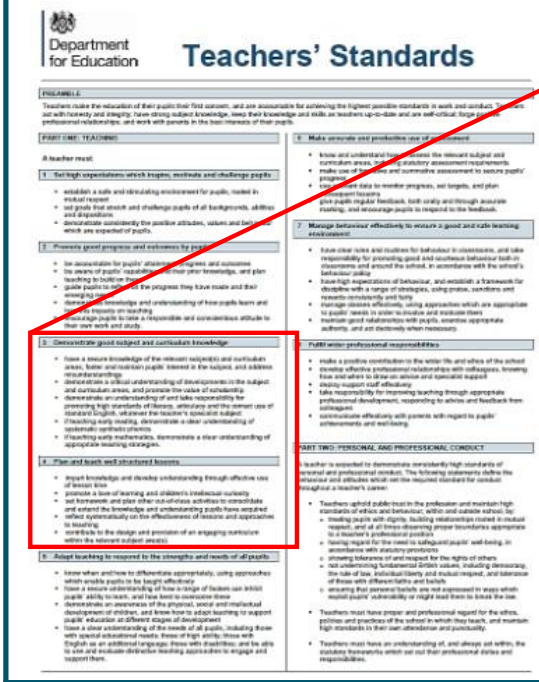
2 Promote good progress and outcomes by pupils

- be accountable for pupils' attainment, progress and outcomes
- be aware of pupils' capabilities and their prior knowledge, and plan teaching to build on these
- guide pupils to reflect on the progress they have made and their emerging needs
- demonstrate knowledge and understanding of how pupils learn and how this impacts on teaching
- encourage pupils to take a responsible and conscientious attitude to their own work and study.

Evidence: through lesson plans along with progression tracking or attainment data.

Before I continue, I wanted to recap on the Teachers' Standards and break down what I intend to focus on in this presentation. Taking each Section apart, Sections 1 and 2 of Part One would be evidenced through lesson plans along with progression tracking or attainment data. Sections 3 and 4 **(as shown below)** focus on subject knowledge and the ideas that surround and underpin high quality lesson planning which hopefully I'll show you some examples of later in this presentation.

Teachers' Standards Part One: Sections 3 and 4


Department for Education

Teachers' Standards

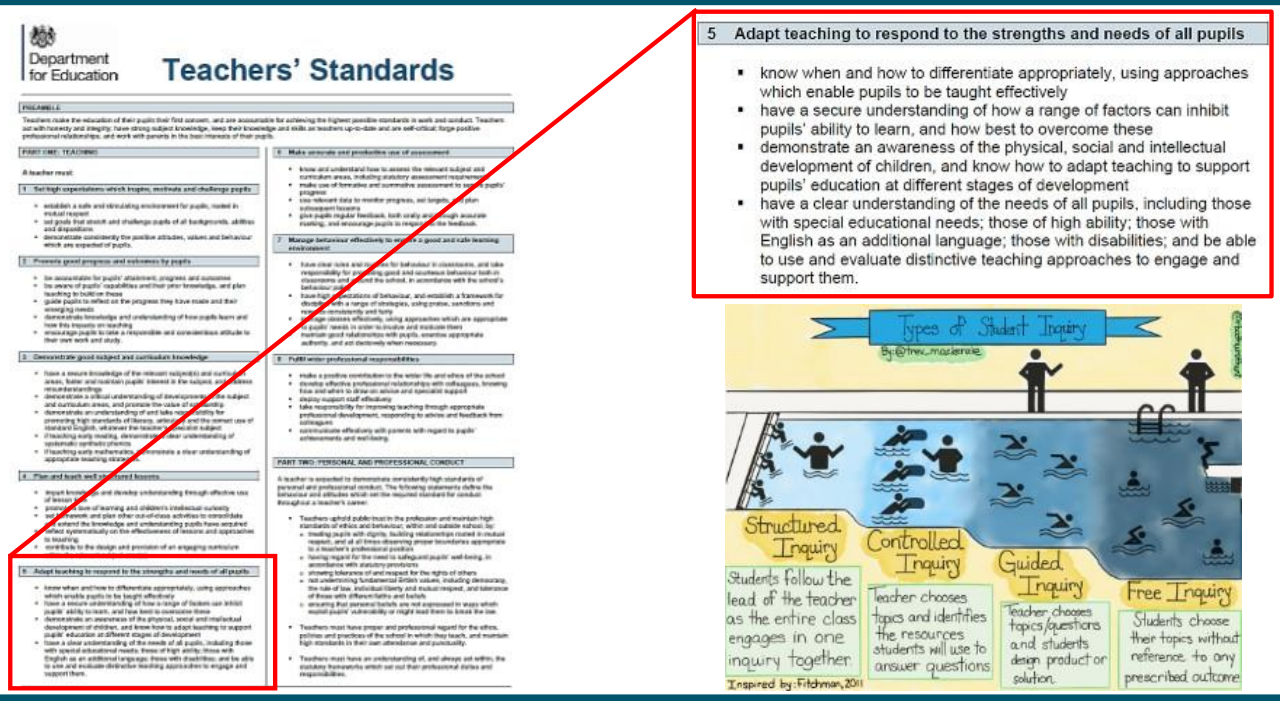
3 Demonstrate good subject and curriculum knowledge

- have a secure knowledge of the relevant subject(s) and curriculum areas, foster and maintain pupils' interest in the subject, and address misunderstandings
- demonstrate a critical understanding of developments in the subject and curriculum areas, and promote the value of scholarship
- demonstrate an understanding of and take responsibility for promoting high standards of literacy, articulacy and the correct use of standard English, whatever the teacher's specialist subject
- if teaching early reading, demonstrate a clear understanding of systematic synthetic phonics
- if teaching early mathematics, demonstrate a clear understanding of appropriate teaching strategies.

4 Plan and teach well structured lessons

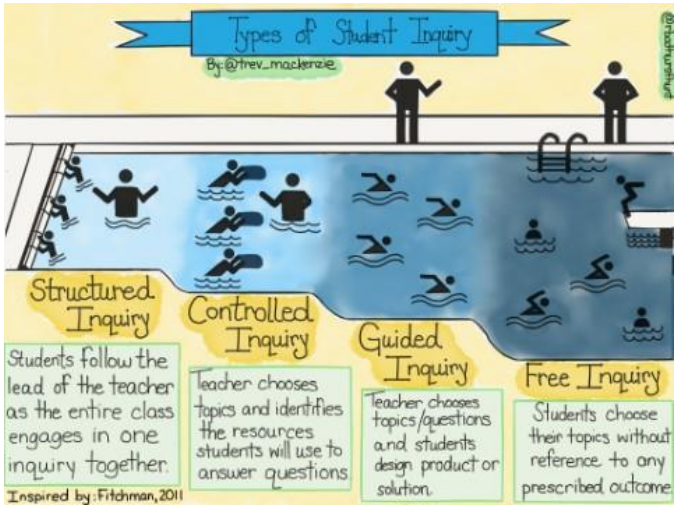
- impart knowledge and develop understanding through effective use of lesson time
- promote a love of learning and children's intellectual curiosity
- set homework and plan other out-of-class activities to consolidate and extend the knowledge and understanding pupils have acquired
- reflect systematically on the effectiveness of lessons and approaches to teaching
- contribute to the design and provision of an engaging curriculum within the relevant subject area(s).

Teachers' Standards Part One: Section 5 -Differentiation



Section 5 of the Standards clearly refers to differentiation. Taking an 'Inquiry based Learning' approach means differentiating four instead of three ways. For my School, I've adapted the 'Inquiry based Learning' into these standards or competencies given the very predominantly practical nature of Computing.

Inquiry based learning approach example



Tier	Competency based descriptor
Pioneer	is able to demonstrate that they have independently achieved all of the Success Criteria and extension challenges for the session.
Navigator	is able to demonstrate that they have been able to follow the instructions set for the Learning Outcome to the model of the session.
Discoverer	demonstrates that they have partially followed the instruction set for the Learning Outcome to the model of the session.
Explorer	demonstrates an understanding of the Learning Outcome from the session by commenting on what they have learnt from the session through recording "I noticed…"; "I liked…" and "I wonder…" Learning Outcome self-review statements.

Here's a real example from my Year 5 Class which I taught during British Science Week in March 2021.

Applying Inquiry Based Learning to Computing

Computing > Year 5 > Session 1 of 16 > Coding > BBC micro:bits

Learning Outcome: "We are learning about..."
...programming BBC micro:bits
Success Criteria:
I can predict what I think something new will do.
I can explore something independently.
I can explain what I found.
Starter activity (10 mins)
To finish off Science week this week, I'm going to give you a chance to explore on your own the BBC micro:bit. These are playing sized card computers that you can programme to make patterns and maybe do things when you get really good at programming them. When after school clubs can start again, we will be using these to try to build a machine or robot that can automatically water plants. We can also build a machine that knows when somebody is walking past it. We might also be able to build a robot or machine that will know how much traffic pollution is outside our school.

Tier	Year 5 Coding micro:bits
Pioneer	is able to **independently** access the web sites and use the block programming features from that website to make the micro:bit display random numbers. Able to transfer their code to the device as well as save their script.
Navigator (Could)	is able to access the websites with support and use the block programming features to replicate the example code and make the micro:bit display random numbers.
Discoverer (Should)	is able to access the example code that has been given from the website and transfer the code to make the micro:bit display random numbers.
Explorer (Must)	completes the "I noticed..."; "I liked..." and "I wonder..." Learning Outcome selfreview statements from the session.

It would be easy for me to simply say "Please refer to the statutory guidance issued by the Department for Education back in September 2013." But that would not only be remiss of me given my enthusiasm for the subject but a dereliction of my duties of my wider professional responsibilities as a teacher.

The Primary ComputingCurriclum for Schools in England

Department for Education

Statutory guidance

National curriculum in England: computing programmes of study

Published 11 September 2013

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Key stage 1
Key stage 2
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Key stage 4

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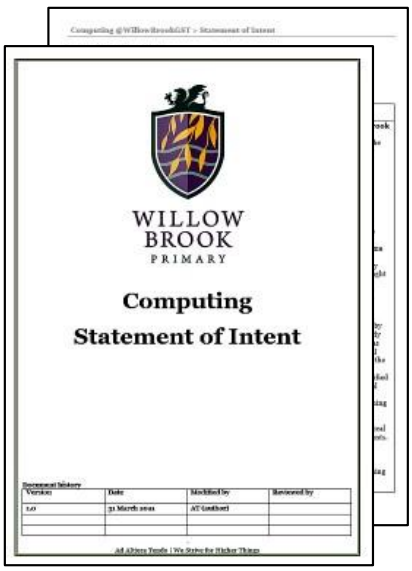
Purpose of study

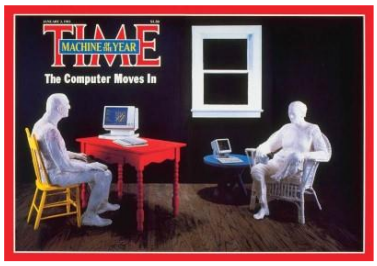
A high-quality computing education equips pupils to use computational thinking and creativity to understand and change the world. Computing has deep links with mathematics, science and design and technology, and provides insights into both natural and artificial systems. The core of computing is computer science, in which pupils are taught the principles of information and computation, how digital systems work and how to put this knowledge to use through programming. Building on this knowledge and understanding, pupils are equipped to use information technology to create programs, systems and a range of content. Computing also ensures that pupils become digitally literate – able to use, and express themselves and develop their ideas through, information and communication technology – at a level suitable for the future workplace and as active participants in a digital world.

https://www.gov.uk/government/publications/national-curriculum-in-england -computing-programmes-of-study/national-curriculum -in-england-computing-programmes-of-study
(last visited: 9 April 2021)



So let's take an opportunity to go a little cross curricular with the Primary History Curriculum where the statutory guidance stipulates learning about "changes within living memory".

Cross curricular with Primary History: "changes within living memory"



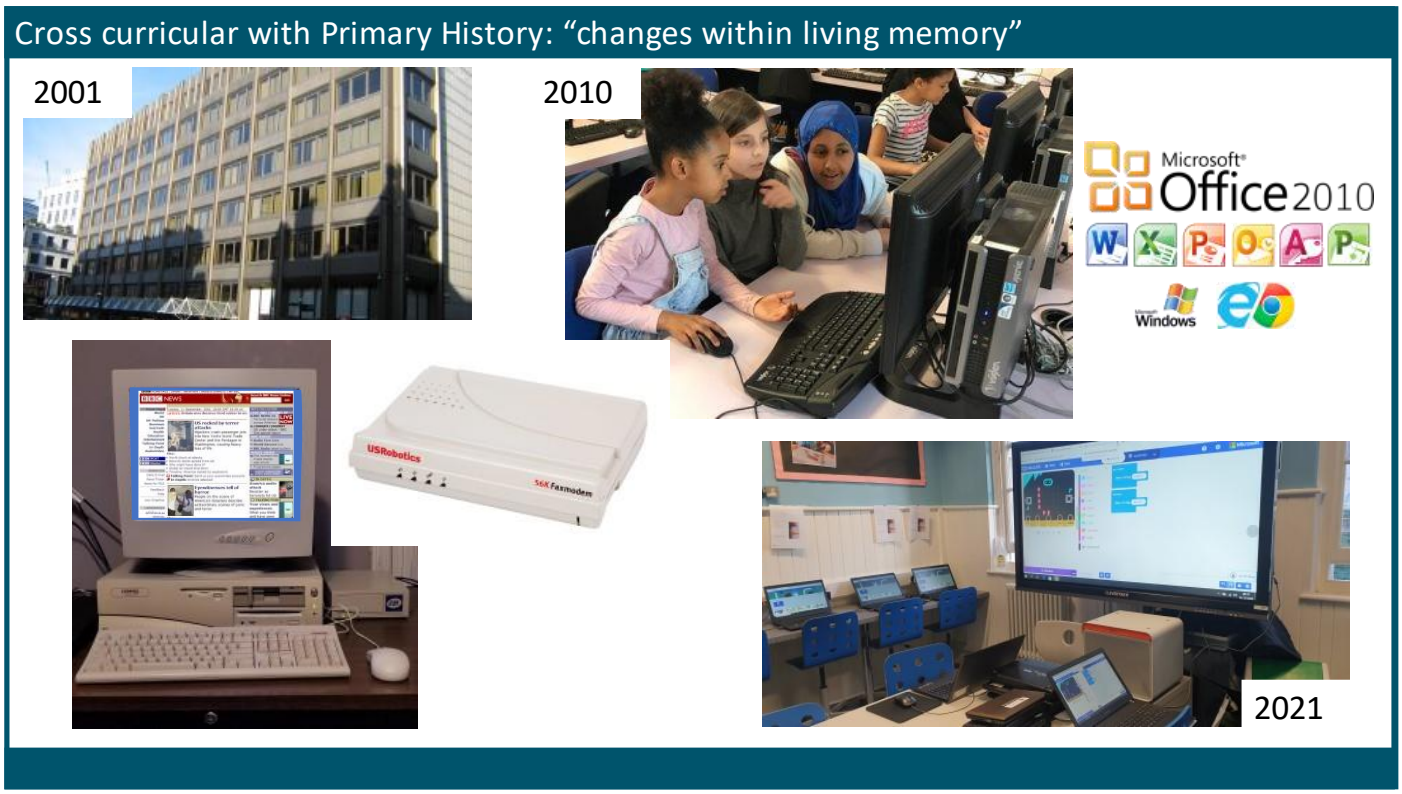
1982

1986

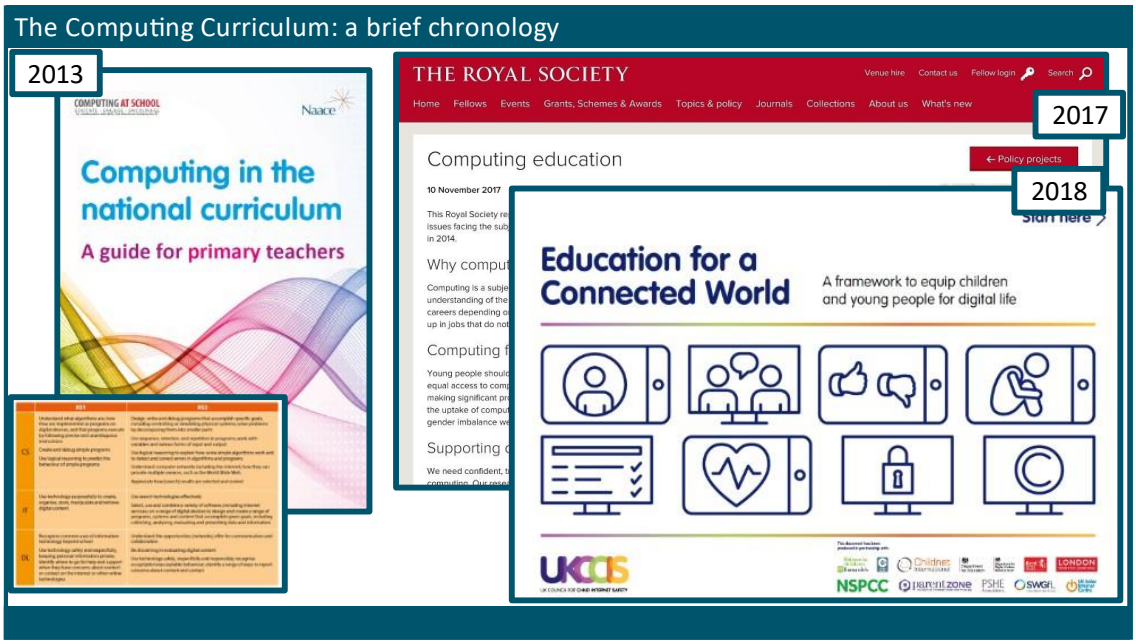
For me, computers or computing became part of my life in 1982 when my parents bought me my first computer. Fast forward almost forty years and the Raspberry Pi 400 has the same or similar physical plug into a TV and start programming or coding properties as the Commodore Vic-20 but at less than a third of the price. I started working in the Civil Service in 1986 where being very keyboard proficient meant that I was delegated the task of being one of the few who got to use the stand alone computer. Because of the noise of the dot matrix printer and the fear of static electricity corrupting the equipment, the computer and printer occupied its very own office space in a room that could comfortably had three or four people working together. My first experience of a computer for educational purposes was in 1993 when I became a student at Birkbeck College. By this time, the Education Reform Act of 1988 which established the National Curriculum included ICT as "compulsory" (source: https://www.gov.uk/government/publications/ict-in-schools-2008-to-2011, last visited 10 April 2021).

I worked for the Civil Service for nearly 24 years with three quarters of my time based in offices by St Paul's Cathedral. It was during this time that I saw and was part of a workplace transformation project or scheme where the workplace moved from individual teams have Local Area Networks to by the time I left in 2010 a Wide Area Network system with computers installed on every desktop for 8,000 staff across over 100 offices. Hard to believe that it was only just over twenty years ago that Government Departments were still using dialup modems to connect to the Internet. I was one of the few offices that had such a facility and I remember in September 2001 when people gathered around my computer to read and watch BBC News online as events we will never forget unfolded. As I mentioned, I left the Civil Service in 2010 and began to volunteer in a brilliant Primary School where the Headteacher realised I was quite good at working with Computers and offered me a paid role on a part-time basis as its Technician essentially. During my own PGCE year, I was fortunate enough to complete a placement at the school and got to teach ICT where essentially it was about learning how to use Microsoft Office and other applications or software. I qualified

in 2012 and joined the amazing School I work for today in 2015. My current Headteacher offered me the role of subject lead for Computing before the start of this current school year although I've been "*thinkering*" (portmanteau courtesy of Professor Danielle George, recipient of the 2018 Michael Faraday Royal Society Prize and Lecture) as it were around technology for teaching and learning since 2016 when I became one of the first wave of Raspberry Pi Certified Educators.

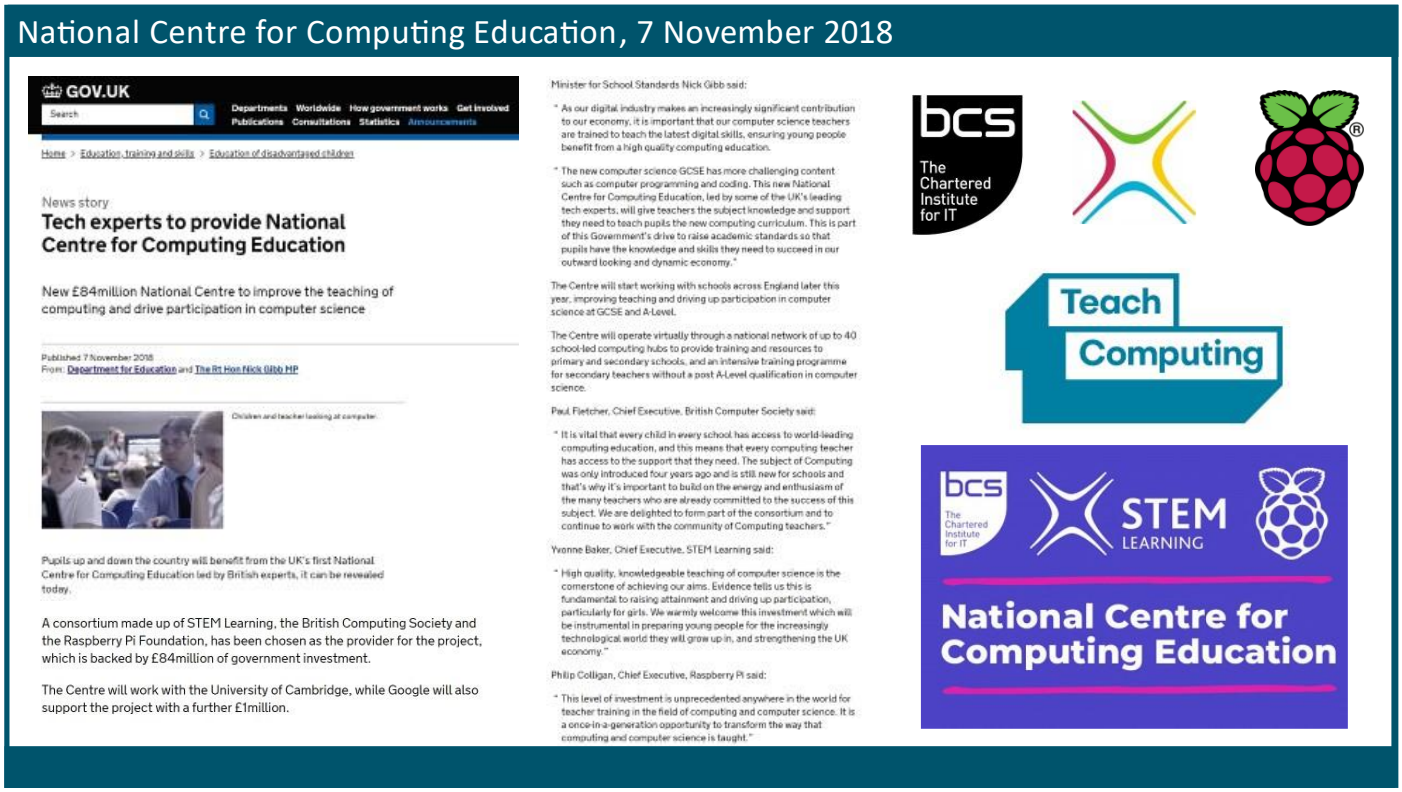


It was the General Election of 2010 and subsequent change of Government which galvanised the Computing at Schools network with support from the National Association for Education Technology (NAACE) to produce this report in 2013 as a commentary of the re-organisation of the National Curriculum especially from ICT to Computing or Computer Science.



[From slide on previous page] The biggest step change was the very clear introduction or expectation that programming or coding would become a more significant element within the topics to be covered. The Computing at Schools report essentially broke down Primary Computing into three elements – Computer Science which covers the coding aspect, Information Technology and Digital Literacy. Similarly, the Royal Society "After the Reboot" review of the 2013 Computing Curriculum highlighted interest in how computer based systems in our every-day lives have facilitated mass data collection opportunities merits Data Science being its own discrete element of the computing curriculum, specifically separate from Digital Literacy or Information Technology. Such an approach would not only enable learning about how such data is used, stored and shared but also encourage philosophical debate (Philosophy for Children or "P4C") about ethical and moral implications of such technologies. It was also at this time that the UK Council for Child Internet Safety (speaker note: who since July 2018 have become the UK Council for Internet Safety which is a Non-Departmental Public Body comprising of representatives from the Department for Culture Media and Sport and Home Office working with the Department of Education) published its first of these reports to address rising concerns over the safe use of computers as communications devices as well as concerns around how easily accessible inappropriate content was available on the Internet.

In recognition of all of this, the Department for Education in 2018 allocated £84 million to the establishment of the National Centre for Computing Education which was formed by the National STEM Learning Centre alongside the Raspberry Pi Foundation and the BCS, the Chartered Institute for IT.



By following their principles and standards, my bosses are about to sign off on my School's statement of Intent which reads:

Computing at Willow Brook

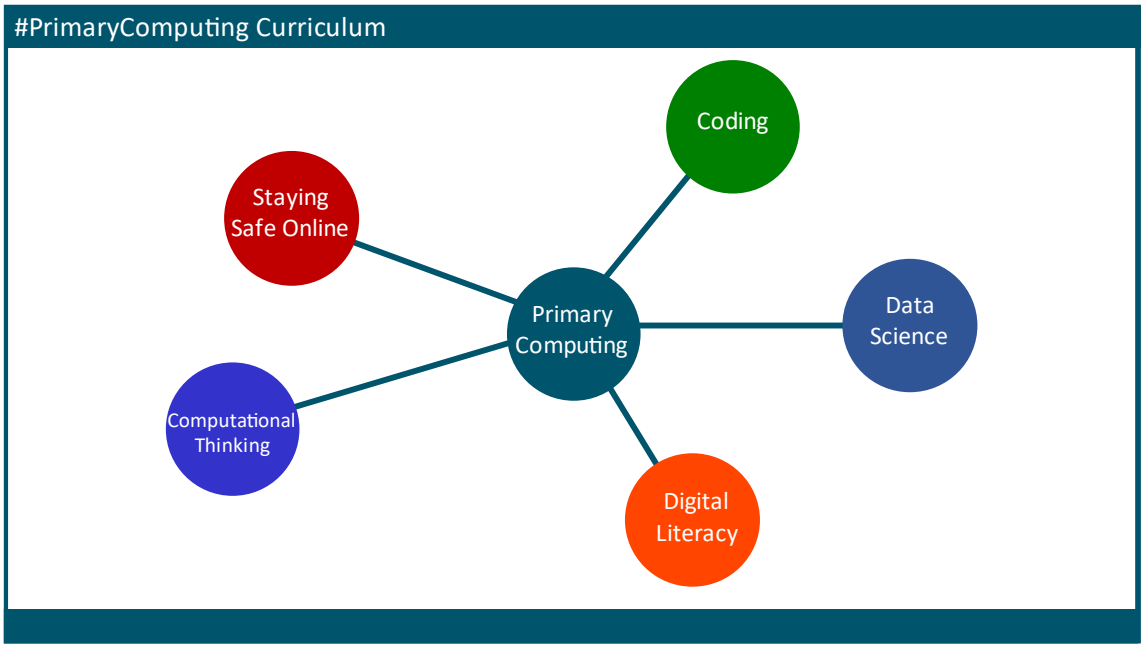
Intent

Computing at Willow Brook follows the principles, practices and standards set by the **National Centre for Computing Education** The School has since 2016 been accredited as a **Centre of Excellence** for teaching Computing by the BCS (the chartered Institute for IT) through its **Computing at Schools** network. By working in collaboration with a number of Universities and other World leading learning institutes ensures that the School's Computing curriculum is continuously connected to the most innovative pedagogical and technological thinking and developments.

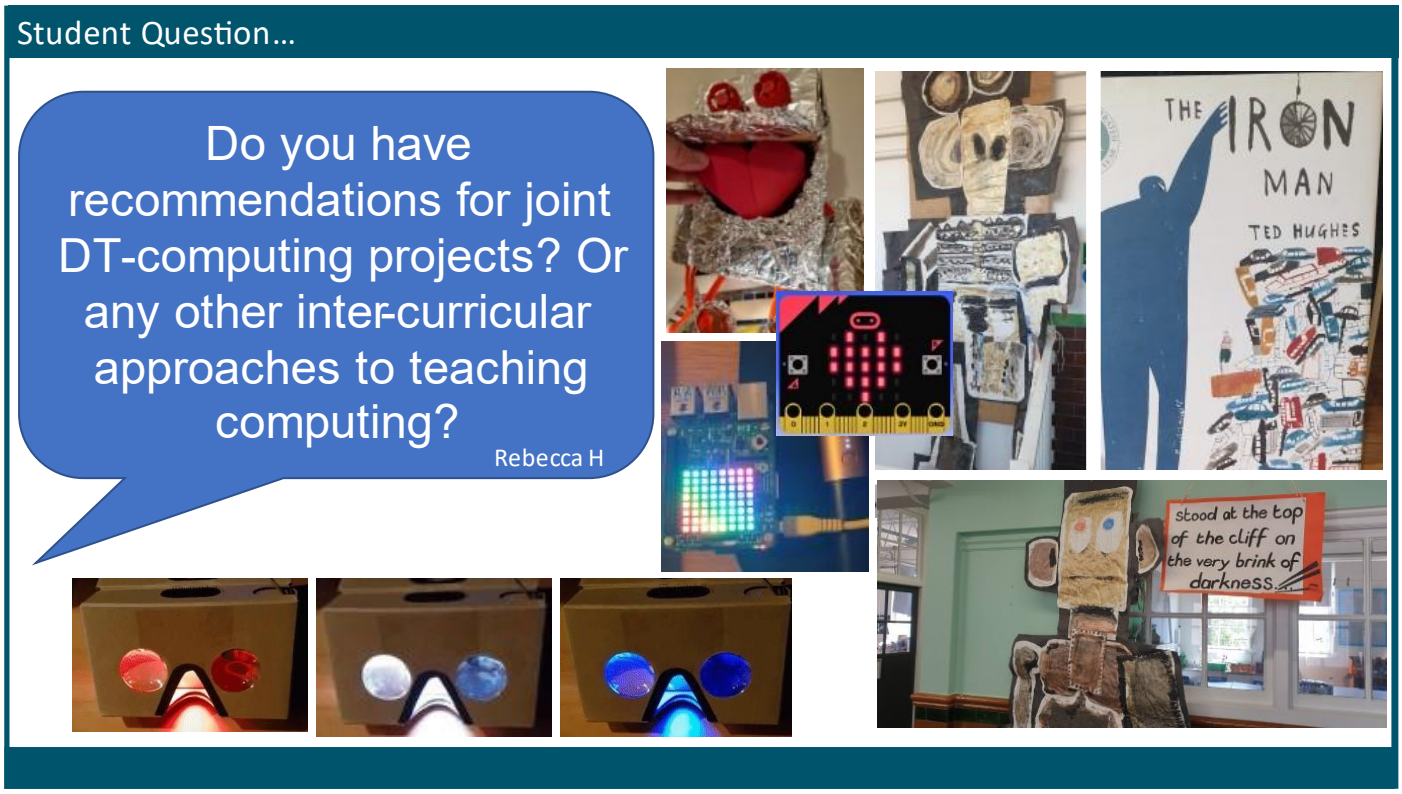
Slide 1 of 4 Statement of Intent

Before I talk on about the design and delivery of the Computing Curriculum at the school I work for, I wanted to mention the Computing at School's network again. Computing at School's is a grassroots network founded in 2008 and supported by the BCS, the Chartered Institute for IT (formerly known as the British Computing Society). You can find out more about the work of the Computing at School's Network and its importance in shaping the landscape of computing in schools by watching the 2020 Kavli medal lecture from one of the network's co-founders, Simon Humphreys.

Computing at Schools Network

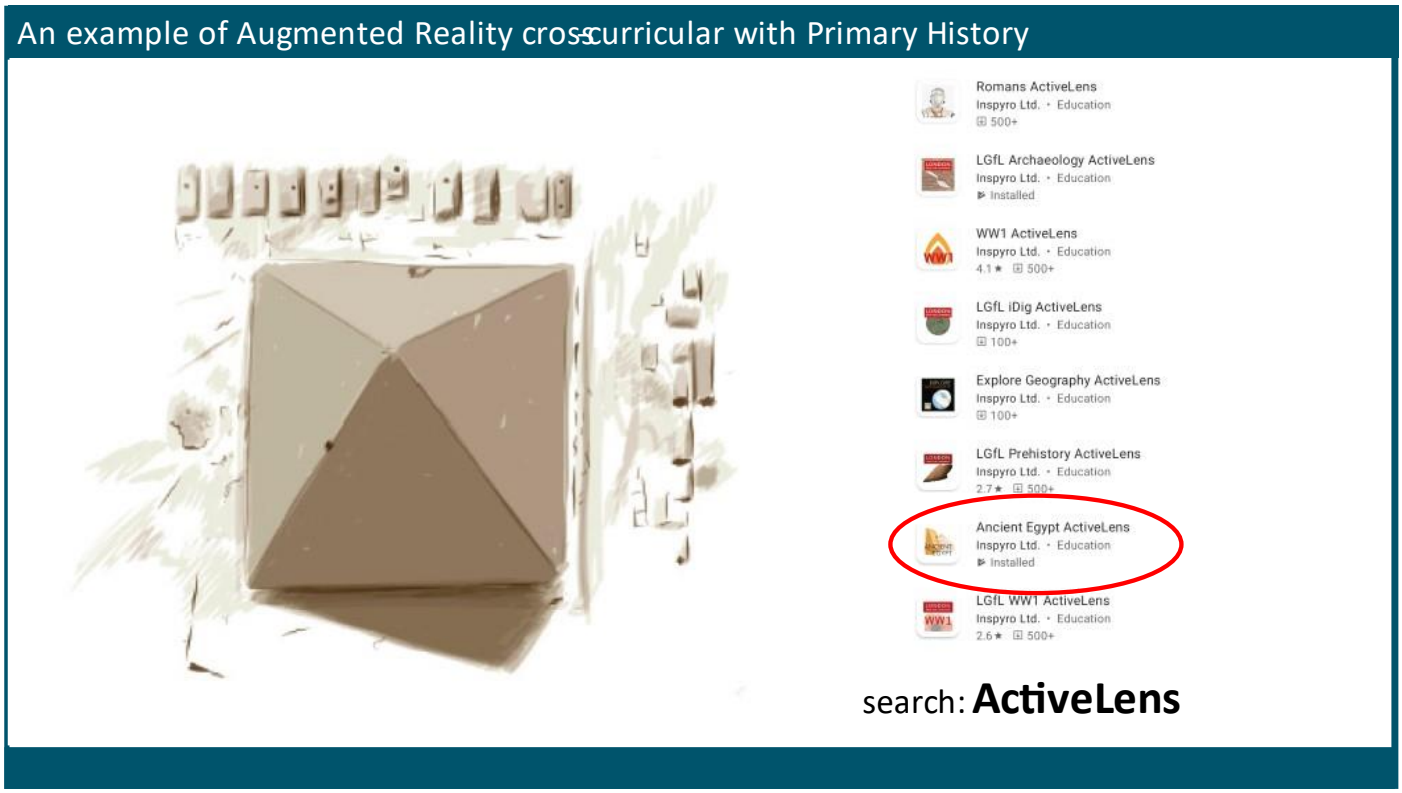


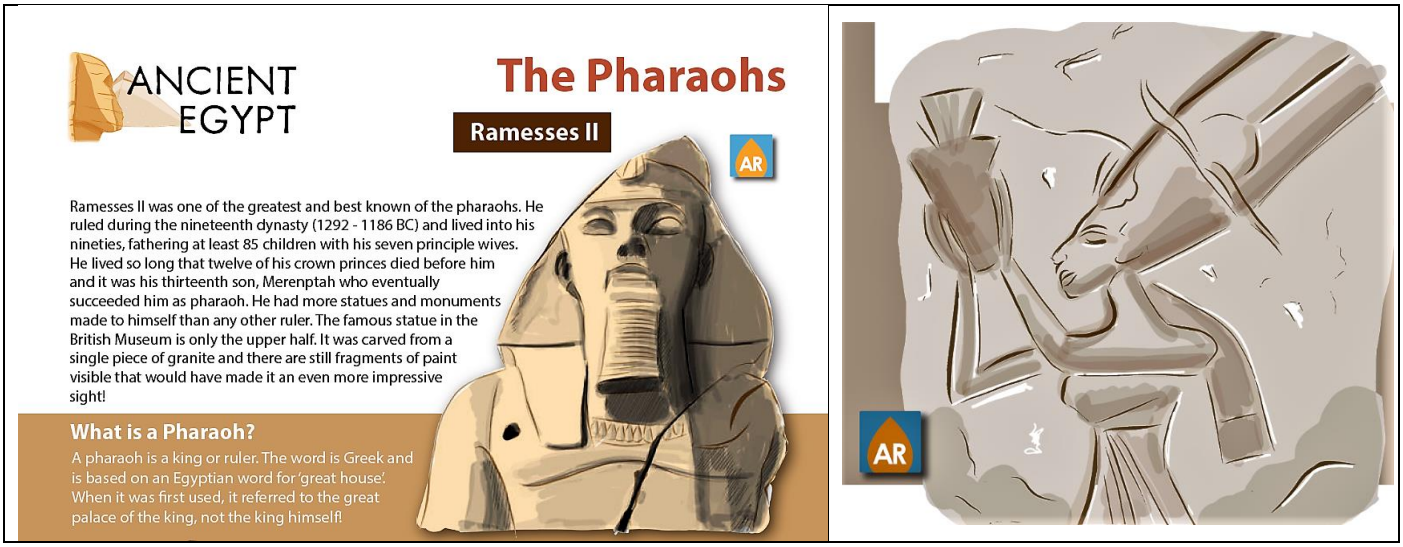
So back to where we are with the way the Primary Computing curriculum might be organised into these five blocks, elements, components – call them whatever you want or will. If we take one of the suggestions or recommendations made by Simon Humphreys from his lecture of offering an hour a week of Computing to every class, you'll soon realise that there isn't enough time to cover the entire Computing curriculum, let alone any of the other subjects which as Primary practitioners we are under statutory obligation to deliver. So, some aspects will need to be covered in other ways – such as keeping the staying safe online as assemblies. Work with colleagues to deliver many of the Digital Literacy aspects through other subjects or alternatively anchoring the Computing lessons around the topics being covered elsewhere in the Curriculum. At this point, let's take one of the questions that were submitted before the today's session from Rebecca H.



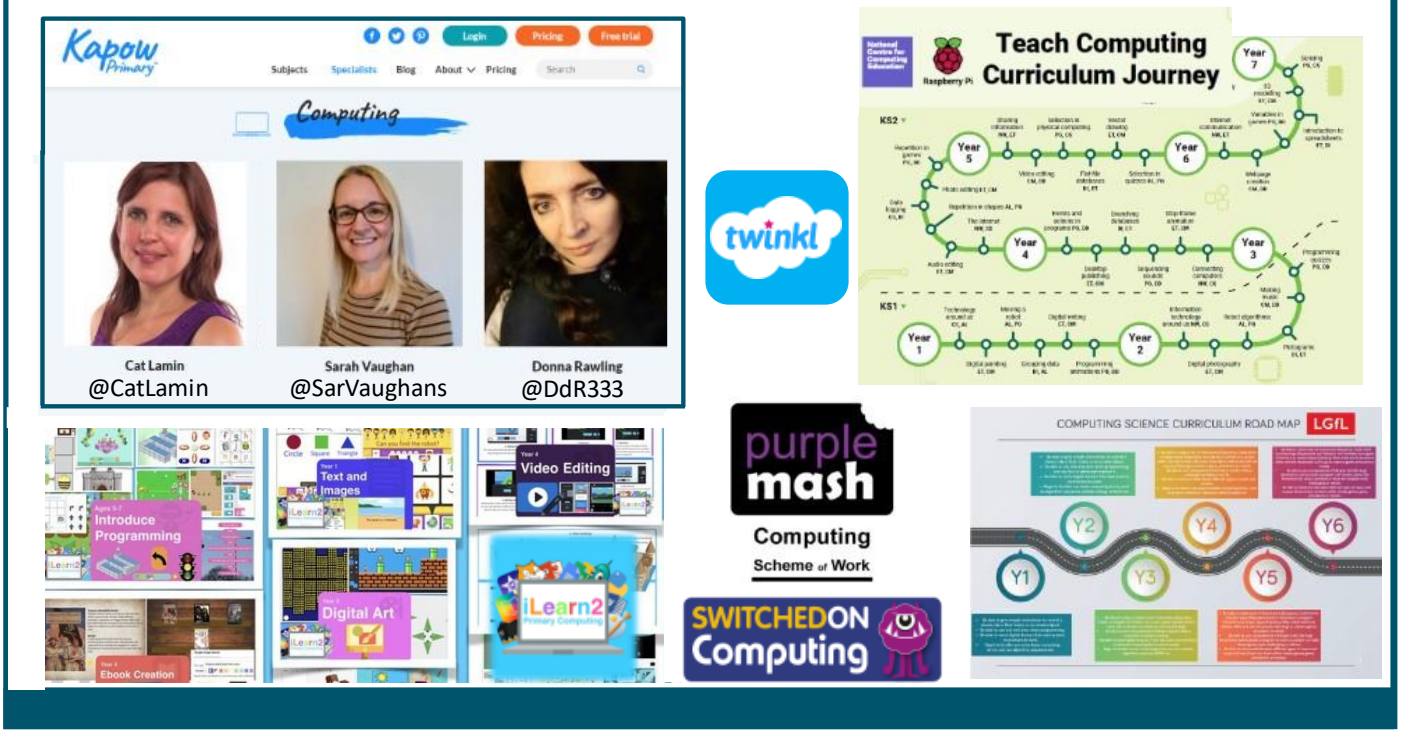
The slide on the previous page showed a very cross-curricular approach with Art and English for the Year 3 series of lessons based on "The Iron Man" by Ted Hughes. My wonderful colleague, Mr Sanders who teaches Art had worked with the classes to create these larger than life cardboard models which are hanging outside their classrooms and in the stairwell of the school. By using BBC micro:bits the children were able to build smaller scale models of "The Iron Man" and give their models a beating heart. For the larger models, using a Raspberry Pi sense-hat as previously featured in the International Space Station Astro Pi projects, it was possible to show the children how with a few very simple lines of code it was possible to get the sense-hat device to flash red, white and blue as "The Iron Man" eyes do in the story.

Here's another example. Search for "ActiveLens" from your smartphone's apps store and download the app as listed below. Using the app, watch what happens to the images **shown**. Augmented Reality is a great way of combining digital literacy and computational thinking along with a bit of Data Science and potentially Coding into a lesson from another subject – in this case the History of Ancient Egyptians.



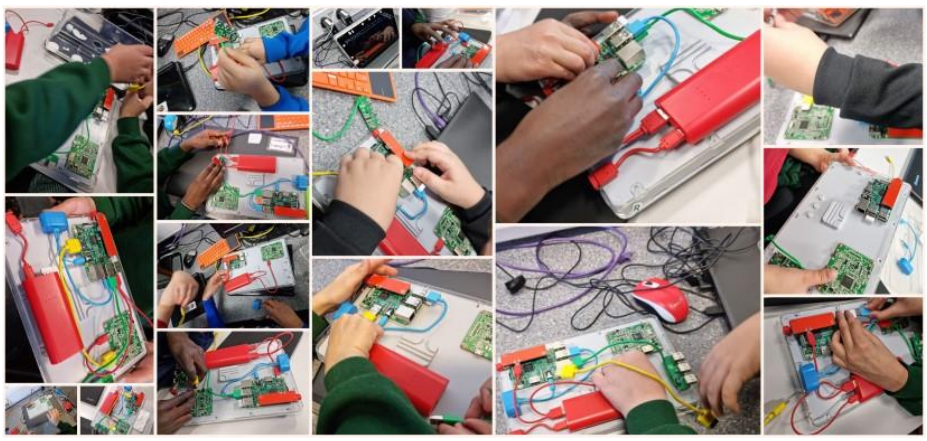


Primary Computing Schemes of Work

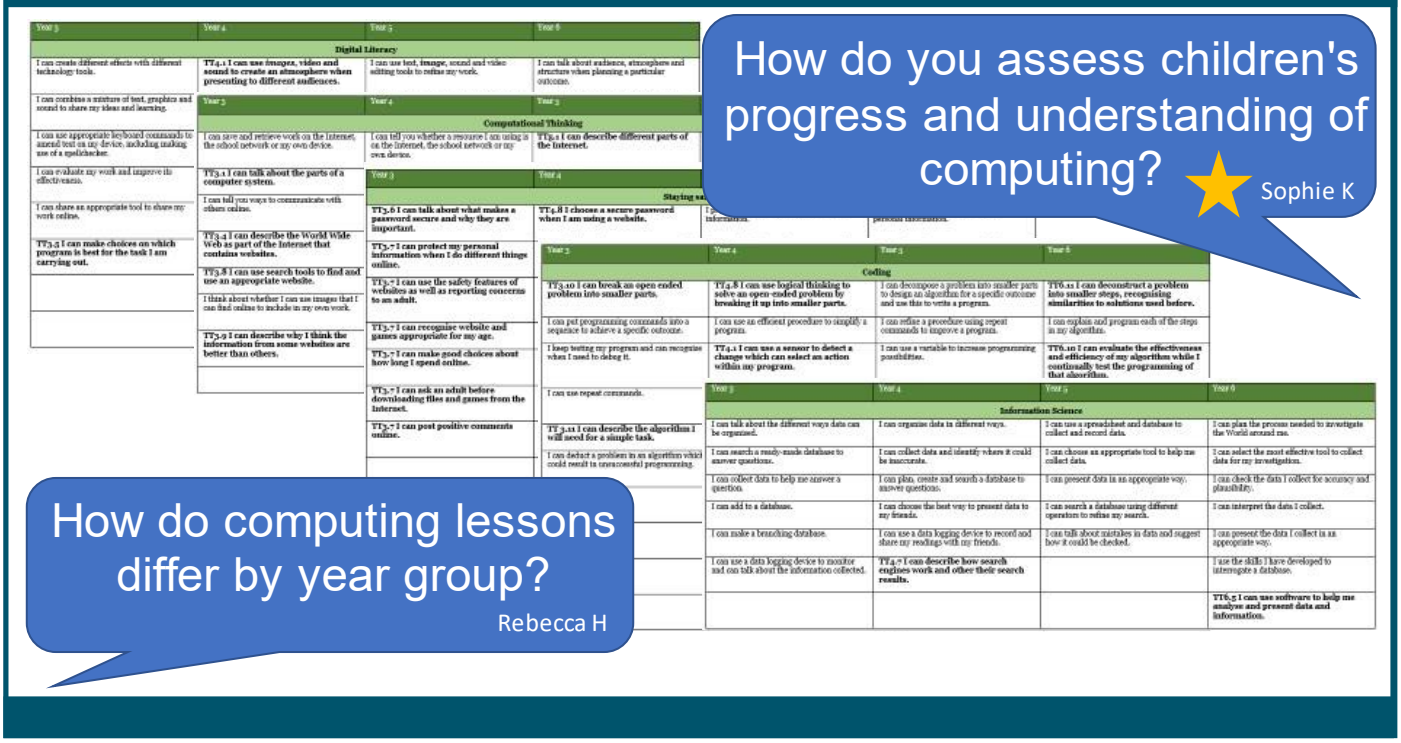


In terms of the order in which the topics across Computing should be covered, I haven't yet seen or experienced any sort of agreed structure that most Computing teachers follow unlike Maths where there is a logical order of concepts to be covered. Here are a list of some of the Schemes of Work that are available. Some can be purchased as private individuals. Some like Purple Mash are only available through School subscriptions. I personally take a mix of all of these and choose the parts I like the most or think work best in my School, with the learners I'm working with and most importantly with the equipment and software I have available. On that I've been fortunate enough to have the support of the Parent Teacher Association who have previously purchased micro:bit drawing robots for the Schools from funds they have raised. A collaboration with Kano in 2018 resulted in receiving a donation of enough Computer Kits Complete for children to work in teams to build their own computers. I was also recently fortunate enough to receive a VexGo kit and PiTop4 which I will use for the after school clubs I will run to introduce the children to robotics and more physical computing.

Year 3 using Kano Computer Kit Complete



Student Questions: #PrimaryComputing Curriculum "I can" statements



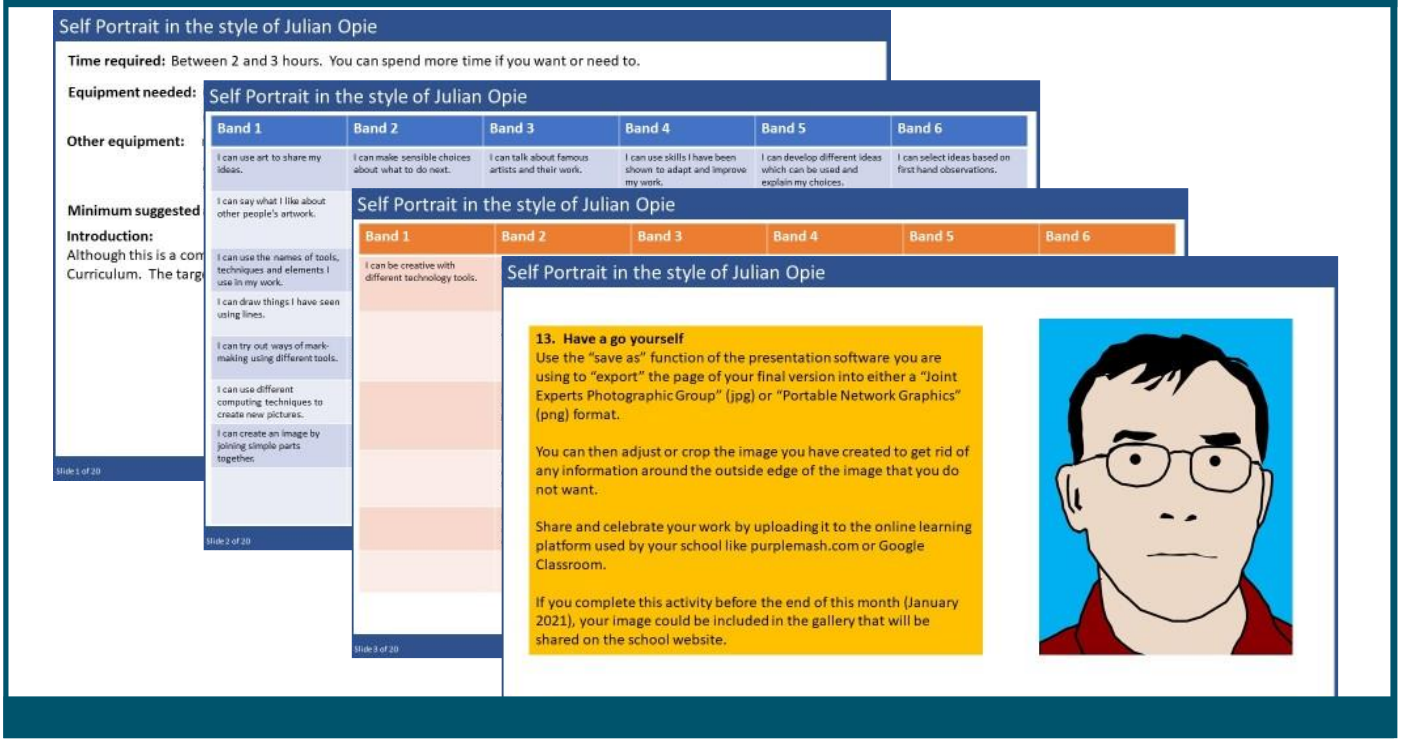
In terms of the planning or implementation process, starting with the "I can" statements, break them down into Success Criteria and organise them into hour long learning sessions. I've said that very carefully and deliberately as the last twelve months have highlighted a number of issues specific I think to how Computing is taught. Firstly, irrespective of all the efforts of everyone with trying to ensure that every family has had access to the Internet and a device for home-learning since March 2020, there are those families who are more digitally literate and those families who for whatever remain on the other side of the digital divide. The implication on our classrooms when teaching Computing is that those who are digitally literate have potentially become more so and those who have struggled over the last year will require even more support with skills like using a keyboard or mouse. On a positive note, "lost learning time" for those who have had regular access to Internet connected devices has been negligible to the point that actually some are even showing skills significantly above Age Related Expectations. It brings me to my second observation that home or hybrid learning opportunities over the last year has meant that some families can and have chosen to be learning at Age Related Expectations that is more personalised.

For a pdf copy of the Primary Computing Progression Map (including Reception and KS1) as featured on the slide shown on this page, please use the QR code on the right.

The Progression Map was adapted from the version produced by Somerset e-Learning and Information Management Service where their version is available to download from the National STEM Learning Centre.

[Presentation and speaker notes continue on the next page]

Example of cross curricular home or hybrid learning activity



By way of specific example, I prepared this home learning digital art activity with Learning Outcomes relevant to every year group for both Computing and Art.

A pdf copy of this activity pack and teaching notes is available to download by using this QR code.

This highlights a point as a personal observation, rather than be restricted to the pressures of "Age Related Expectations", if we as teachers were able to provide every learner with a highly personalised pathway and approach learning as a continuous journey from Reception through to post 16, the experience of school for learners might become more rewarding. This is certainly the approach I've observed from my colleagues who teach PE where their learning outcomes are based on personal achievements rather than age related "must", "should" and "could" ideals. Hopefully, this answers Rebecca's question about how computing lessons differ by year group.

Marshalling all of these ideas together, and thinking from a School Senior Leader perspective, colleagues at my current school have expected to be presented with a Curriculum Map at the beginning of the school year which looks like this [Slide on the next page]. Essentially it sets out the half termly blocks of learning that are expected to be delivered. And it's beyond that point that as teachers we drill down into the detail of each lesson plan.

[Presentation and speaker notes continue on the next page]

Primary Computing Curriculum Map Overview – Topic Blocks

30-40 sessions pa	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Reception	All about Instructions (5 sessions)	Programming Bee -Bots (5 sessions)	Exploring Hardware (5 sessions)	Using a Computer (5 sessions)	Introduction to Data (5 sessions)	Introduction to Media (5 sessions)
Year 1	Technology Around Us: Intro to Computing (6 sessions)	Creating Media 1: Digital Painting (6 sessions)	Creating Media 2: Digital Writing (6 sessions)	Coding: Moving a robot (6 sessions)	Creating Media Y1 Project (6 sessions)	Coding: Make Art Digital Artists (6 sessions)
Year 2	Introduction to Computational Thinking (6 sessions)	Creating Media 3: Photography (6 sessions)	Creating Media 4: Music (6 sessions)	Information Science: Using and making pictograms (6 sessions)	Coding: Robot Algorithms (6 sessions)	Coding: Kano Digital Artists (6 sessions)
Year 3	Digital Technologies Around Us (6 sessions)	Animation: (6 sessions)	Desktop Publishing (6 sessions)	Coding: Music Sequencing (6 sessions)	Coding: Introduction to Robotics (6 sessions)	Coding: Kano Digital Artists (6 sessions)
Year 4	Understanding the Internet (6 sessions)	Creating Media 5: Audio editing (6 sessions)	Creating Media 6: Photograph editing (6 sessions)	Coding: Code Club Certificate (6 sessions)	Coding: Introduction to Robotics (6 sessions)	Creating Media Y4 Project (6 sessions)
Year 5	Introduction to Information Science (6 sessions)	Creating Media 7: Vector drawing (6 sessions)	Creating Media 8: Video editing (6 sessions)	Information Science: Flat database (6 sessions)	Coding: Kano (6 sessions)	Coding: Kano Digital Artists (6 sessions)
Year 6	Technology as a Communications Tool (6 sessions)	Creating Media 9 3D-Modelling (6 sessions)	Creating Media 10: Publishing a simple website (6 sessions)	Information Science: Plotting shapes, charts and graphs (6 sessions)	Coding: Python (6 sessions)	Coding: Hackerthon Challenge and iDEA (6 weeks)

I'm sure you've had many opportunities to work with the lesson planning format of the schools that you have experienced so far. At this point, Computing or Computer Science is no different from any other subject. Set out your Learning Intention or Outcome, break it down into Success Criteria with a model that the children can follow. This is where an Inquiry based approach works really well. Following the question that Jemima asked let me use and example of a Reception class lesson where I was introducing them to some concepts in coding.

Student Question…

How would you practically teach an Early Years class of 30 computing?

Jemima S

This week I introduced coding skills to Reception Classes by playing "Get Teddy to Bed" game on their classroom carpet spaces. The aim of the game was :

to give instructions to a friend (using forward, backward and turn) and physically follow their instructions.

According to the Primary Computing Progression Framework distributed by the National Centre for Computing Education (copy downloaded in Summer 2020), this Learning Outcome is an Age Related Expectation for the end of Year 2.

The children followed the PRIMM computing model so had to **predict** how many pieces of fruit Teddy would eat on his journey to bed where Teddy's starting point well as his finishing point would be randomly chosen by the children. The children then took it in turns to **run** their **algorithm** by moving Teddy from his starting point, one piece of fruit at a time until he arrived at the piece of fruit where Teddy's bed was. The children then **investigated** how many different routes there could have been by thinking about and listing the order that the fruit was eaten by Teddy. The children also **modified** their plans by comparing the routes that Teddy could have taken. For their next lesson, the children will be encourage to **make** or plot the routes that Teddy followed by drawing them. The children could also be shown and expected to program a device like a Beebot or other motorised device that can be instructed to follow a sequence of simple instructions to replicate the routes.

This model or lesson can also be used to teach the following Year 3 end of year Age Related Expectations using Scratch:

- **I can break an open ended problem into smaller parts;**
- I can put programming commands into a sequence to achieve a specific outcome;
- I keep testing my program and can recognise when I need to debug it;
- I can use repeat commands;
- **I can describe the algorithm I will need for a simple task;**
- I can deduct a problem in an algorithm which could result in unsuccessful programming.

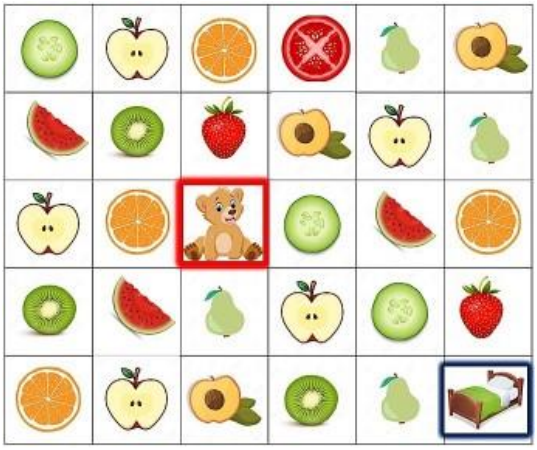
(Statements in bold are key performance Learning Outcomes for the end of Year 3).

The PRIMM model in Inquiry Based Learning

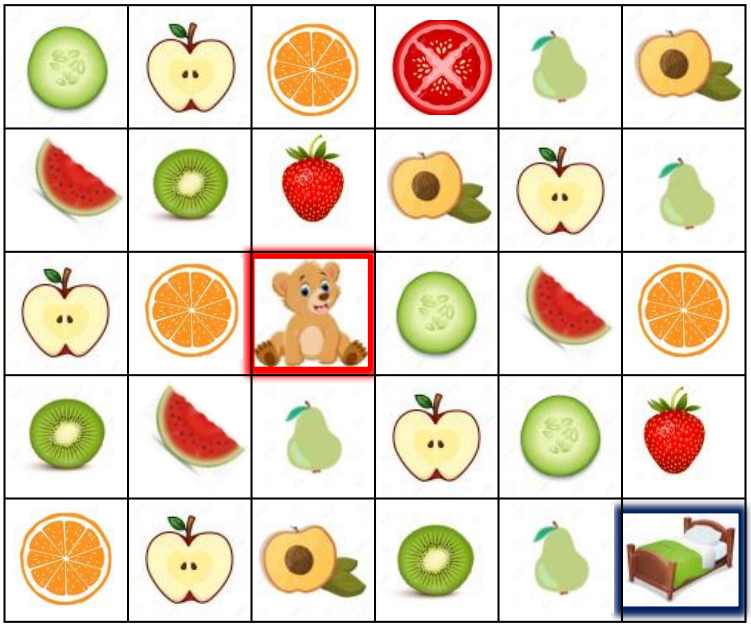
Introduction to Coding in Reception Class

Computing > Reception > Session 5 of 16 > Coding > Introduction to Coding: Teddy Bear's Picnic

Learning Outcome: "We are learning about..."
...simple instructions.
Success Criteria:
I can say what I see is happening.
I can give instructions to my friend using the words "up", "down", "left" and "right".
I can make a map that shows my instructions.
Predict (10 mins)
When I saw you last time, we played a game where we put teddy in bed. Today we're going to play that game again but in a different way. Today we are going to use your teacher's computer to do the same thing. What pieces of fruit will Teddy eat before it goes to bed? Is there another way? Can we find one more way?



Introduction to Coding in Reception Class



The Prediction Phase

What pieces of fruit will 

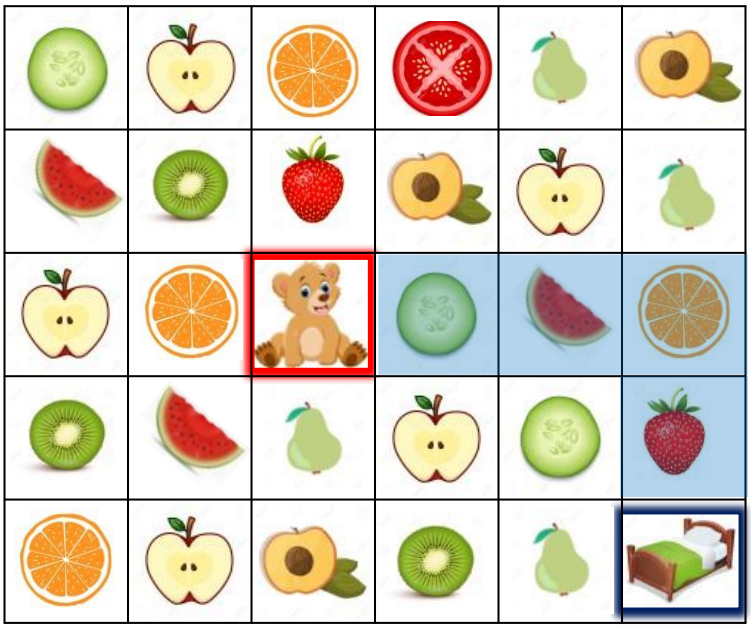
before it can get to 

 Can only move in these ways

The Prediction Phase

[Presentation and speaker notes continue on the next page]

Introduction to Coding in Reception Class



The Run Phase

What pieces of fruit will 

before it can get to 

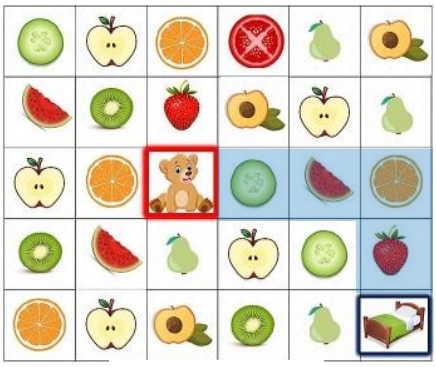
Can only move in these ways

The Run Phase

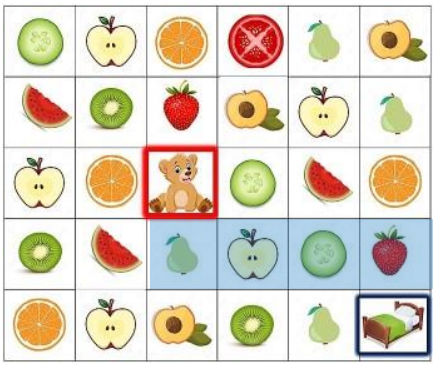
Introduction to Coding in Reception Class

The Investigation Phase

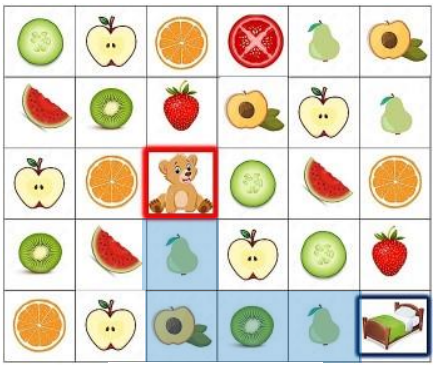
Which one is better? Why?



Route A



Route B



Route C

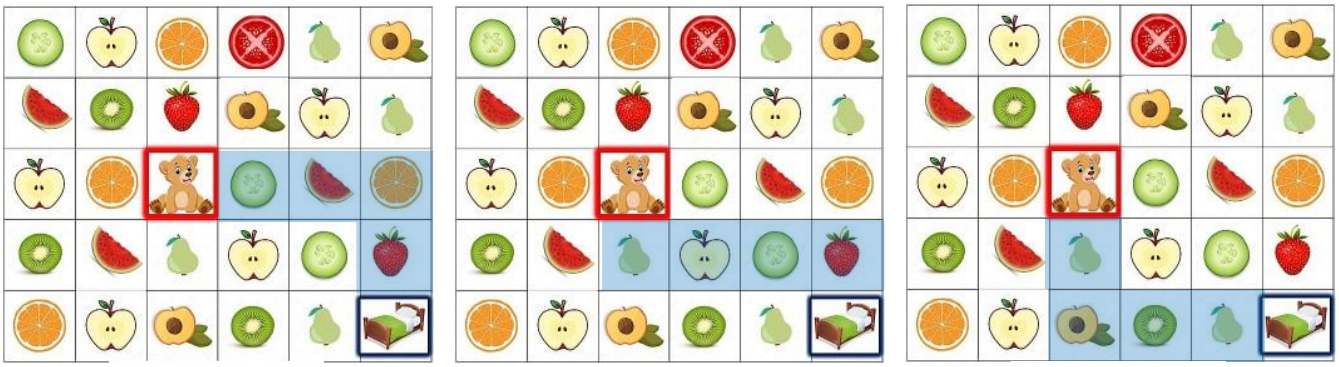
The Investigation Phase which for this lesson has actually been broken up into two parts.

[Presentation and speaker notes continue on the next page]

Introduction to Coding in Reception Class

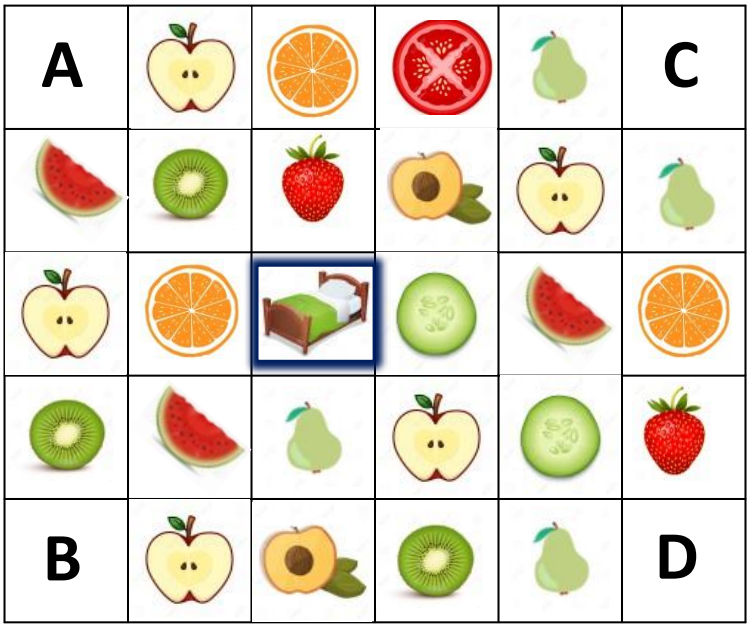
The Investigation Phase

Which route does the code match?



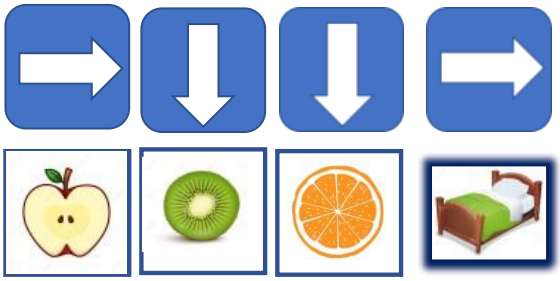
Route A **Route B** **Route C**

Introduction to Coding in Reception Class



The Modify Phase

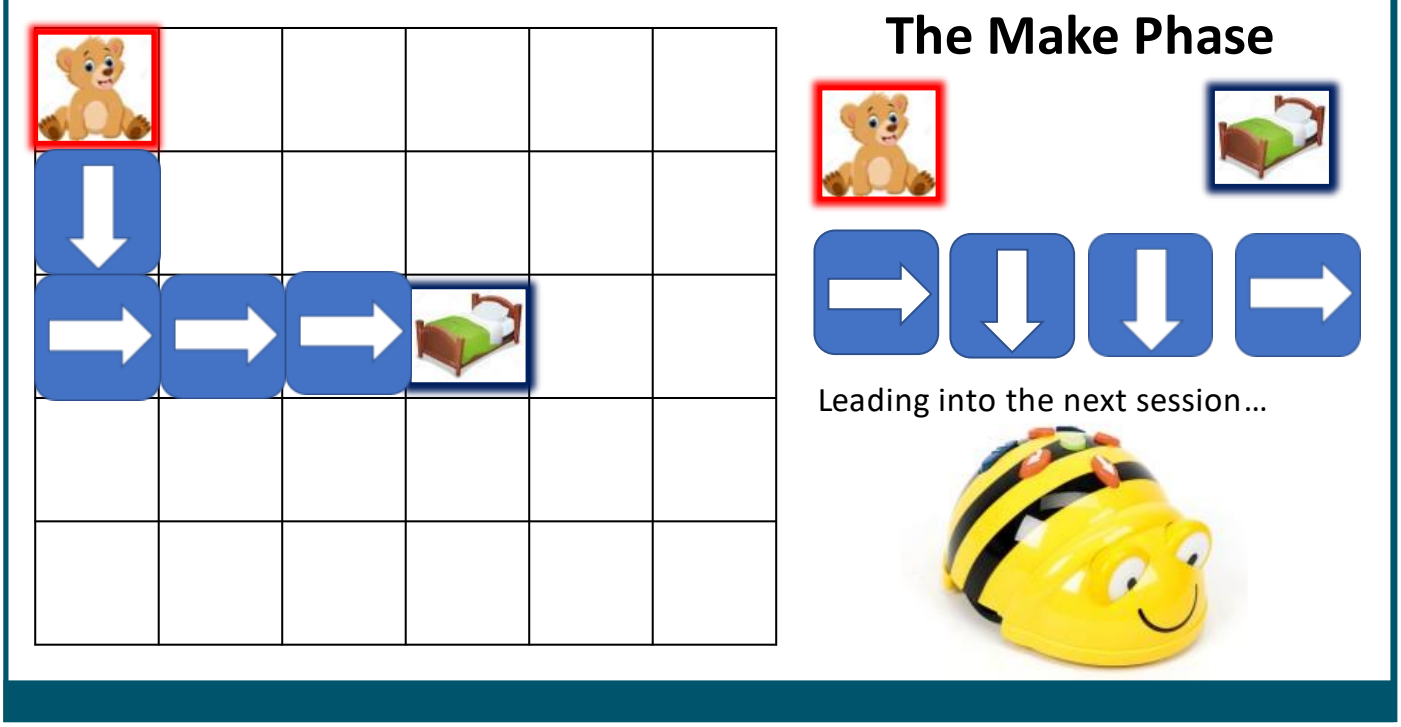
Where is  hiding if it does this



The Modify Phase where the original coding challenge is presented in a slightly different way but still following the same principles.

[Presentation and speaker notes continue on the next page]

Introduction to Coding in Reception Class



The Make Phase where the learners are expected to apply what they have been shown.

Before I finish, in terms of the nuts and bolts of actually teaching Computing, I wanted to share some of the resources that I would rate and recommend. Most of these are currently available to access for free although you might need to jump through a few administrative hoops to get there. Some will have a fee. I've chosen to buy into them because I think they're good value. I kind of see it a bit like buying a textbook. If you like it and have enjoyed using it, then why not. And just to be absolutely clear, apart from Team Kano and Vex Robotics, I have not received anything from these organisations I'm about to mention.

#PrimaryComputing Curriculum: An introductory practical guide

Staying Safe Online

Focusing on Staying Safe Online, you will or should be familiar with the "Keeping Children Safe in Education" Statutory Guidance. When you join your schools, the first INSET of the school year will or should always include a review of this document as it underpins all of our safeguarding obligations and responsibilities as teachers. Since 2019 there have been two other pieces of statutory guidance which specifically impact on Computing. The main one is "Teaching online Safety in School". The other is the guidance on "Relationships and Sex Education" which really is a subject in itself but again has some overlap with the Staying Safe Online parts of the Primary Computing Curriculum. The good news is that there is a plethora of organisations who exist to support the teaching of Staying Safe Online. Two of the leading initiatives currently are the GoogleUK backed #BeInternetLegends and the BT backed with support from the National Crime Agency #BeCyberSafe from Barefoot Computing. All of the insignias I've included on this slide have also done incredible work to support Schools, families and children to ensure that they are Staying Safe Online.

Similarly, so many organisations have devised resources to support teaching Coding. Gone are the days from my youth when what was initially expected was copy-typing in lines of alpha-numeric characters to make a white square blink a trail across on a dark background. The generic term for the type of computer programming that is expected to be covered at Primary level is block coding. The ones I'm listing here [Slide on the next page] are all currently free to access. The ones that charge will link to peripherals of rover like vehicles. Many of them will have quiz type challenges or project ideas for learners to follow. For those who think that their learners particularly in Years 5 and 6 might be able to progress onto text based coding, some of the block coding platforms offer a very transparent switching service to reveal the text based equivalent from the blocks. What I have done here is applied a "RAG" or Red-Amber-Green rating to these apps or websites. I'm obviously not going to waste anybody's time talking about the reds. The amber rated ones are those which I've had experience of using in the classroom and either for technical reasons or cost grounds have not been able to rate them more highly. The middle column are all apps that I currently use in my teaching practice. Scratch I've shown as Amber-Green as I have a virtual Code Club with over 500 children

set up with individual accounts. However, the web site is one I would like to see significantly improved as it really is more suited to classroom use rather than independently learning how to code.

Apps and websites for learning programming or coding

Root Coding	Tynker	Light-bot
Kodeable	Microsoft Make Code	Scratch Jr
code.org	Google CS First	Scratch
Spritebox	microbit.org	Sam Labs
Code for Life	Unity	Wonder Dash
Sphero Edu	codecademy	Lego WeDo

source: Common Sense Education https://www.commonsense.org/education/top- picks/best-apps-and-websites-for-learning-programming-and-coding (last visited 16 April 2021)

Student Question…

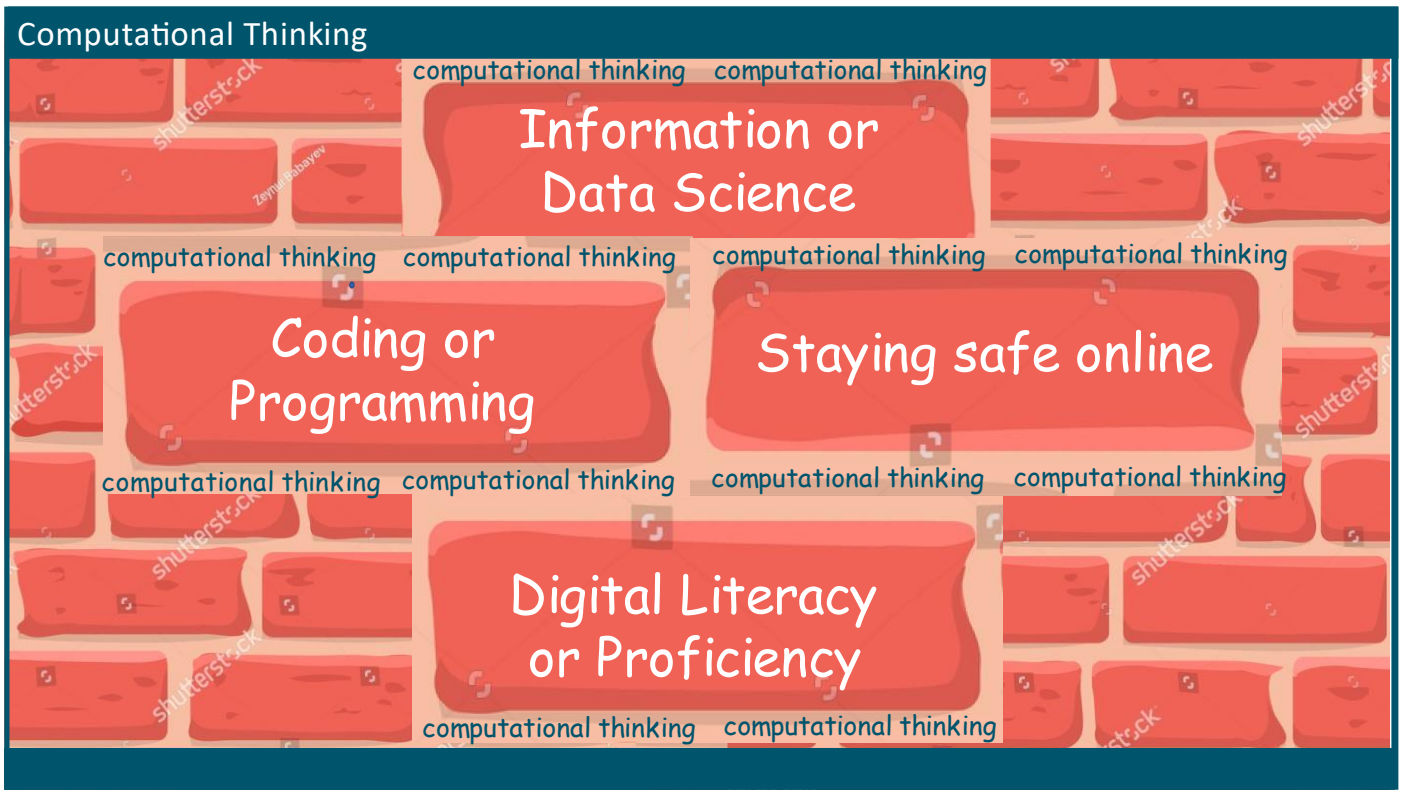
To what extent should you be teaching children to use software in computing and what types of software should you be teaching?

Rebecca H

Rebecca's question is a brilliant one to lead me onto talking about the digital literacy aspects. Depending on the schools you work in, they may have chosen to either use Google for Education or Microsoft 365. I'm really pleased that my school have decided to go with both with the wonderful support from the partnership with the company that has provided the school with hardware and software technical support since 2016.

Given every school's reliance on computing from the teacher's device in the classroom to the systems supporting the running of the school let alone the devices used for teaching and learning, I would strongly recommend that if you do find yourselves in a position where you are either offered or appointed the subject lead role for Computing and there isn't a technical support capacity in place already, speak to your bosses about either having an on-site Computing technician or a contract with a company that can provide the school with the level of technical support that every school needs to keep its hardware and computer systems running efficiently and effectively.

Before we close with looking at the others really thought provoking questions I received, using the metaphor of a learning wall, if Primary Computing were to be organised into these four teaching blocks of Information or Data Science which essentially is a cross over with Maths, Coding, Staying Safe online and Digital Literacy, then computational thinking would form the mortar which joins all of the main blocks together.



So to the rest of the questions that came in. Thank you to Rebecca for sending in these great questions. What is the best way of introducing a new piece of software / integrated development environment (including Scratch)? I would say slowly over a sequence of lessons and introduce the software with a couple of functions at a time.

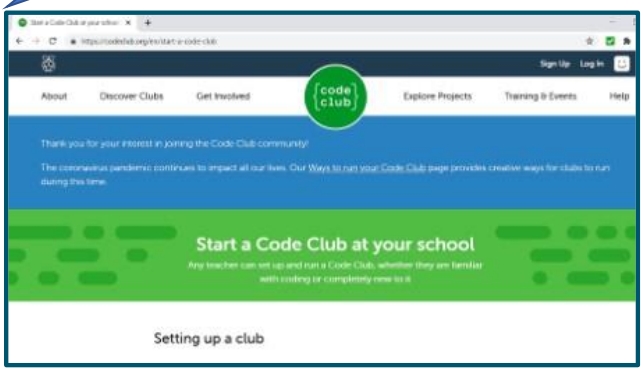
What are your thoughts on just letting the children experiment for the first lesson? Yes, definitely especially with the older year groups. There does need to be some structure with showing "what a good one looks like" but beyond that, there is no reason why as I've suggested, the most able learners as young as Reception could be pioneers, working independently. That's the great feature of learning computing – that it is mostly if not completely experiential.

By far the best teaching is when lessons are so highly structured, well planned and resourced that as a teacher you are proud to be invited to show and share how great the learning is to policy makers. Here were a group children I was tasked to work with in 2017 when we were invited to meet with Vicky Ford MP at the Houses of Parliament. At the time, the current Under Secretary of State at the Department for Education was on the Parliamentary Select Committee for Science and Technology. At her address to the group, she spoke of how impressed she was and unable to distinguish between those children in the group who had special learning needs to the others as everybody was working collaboratively and able to demonstrate what they had been learning to an exceptionally high standard. As for the epic fails, it will not surprise anybody that it is when the technology does not work and there is no off-line back up plan. I experienced this first hand when my very first lesson as subject lead for Computing I thought I would take laptops into the classroom. What I didn't realise was that the laptops hadn't been charged. I hadn't checked which were working adequately. The wifi was intermittent. It took a third of the session to get everybody onto a logged in device at which point the devices began to fall and fail like dominos. By agreeing a priority programme of repairs and servicing for a class set of devices and wiring them for permanent use in a dedicated suite prevents such experiences ever recurring. When technology fails, it is infuriatingly frustrating and highlights the importance of having a great working relationship with a excellent technical support partner as well as senior colleagues in being able to have a strategic plan in place to avoid such "must never happen" incidents.

Student Question…

Do you have any advice for setting up a computing club?

Rebecca H



Advice on setting up a computing club. Definitely sign to Code Club as it has great resources and is very well structured to support an after school or off-timetable programme. Plan the sessions as though they were in-timetable sessions. There's nothing worse I've found in the five years I've been supporting Code Club at my school than just allowing participants to do as they please when actually it is just as valuable teaching and learning time although it's not to be too formal about it. Would also say give the Club a big target to aim for too. For example, I run my club meetings so that the participants meet the criteria to be awarded the British Science Association CREST Awards or Arts Council England Arts Award. The QR code has a link to a blog I wrote for Code Club in September 2020.

Student Question…

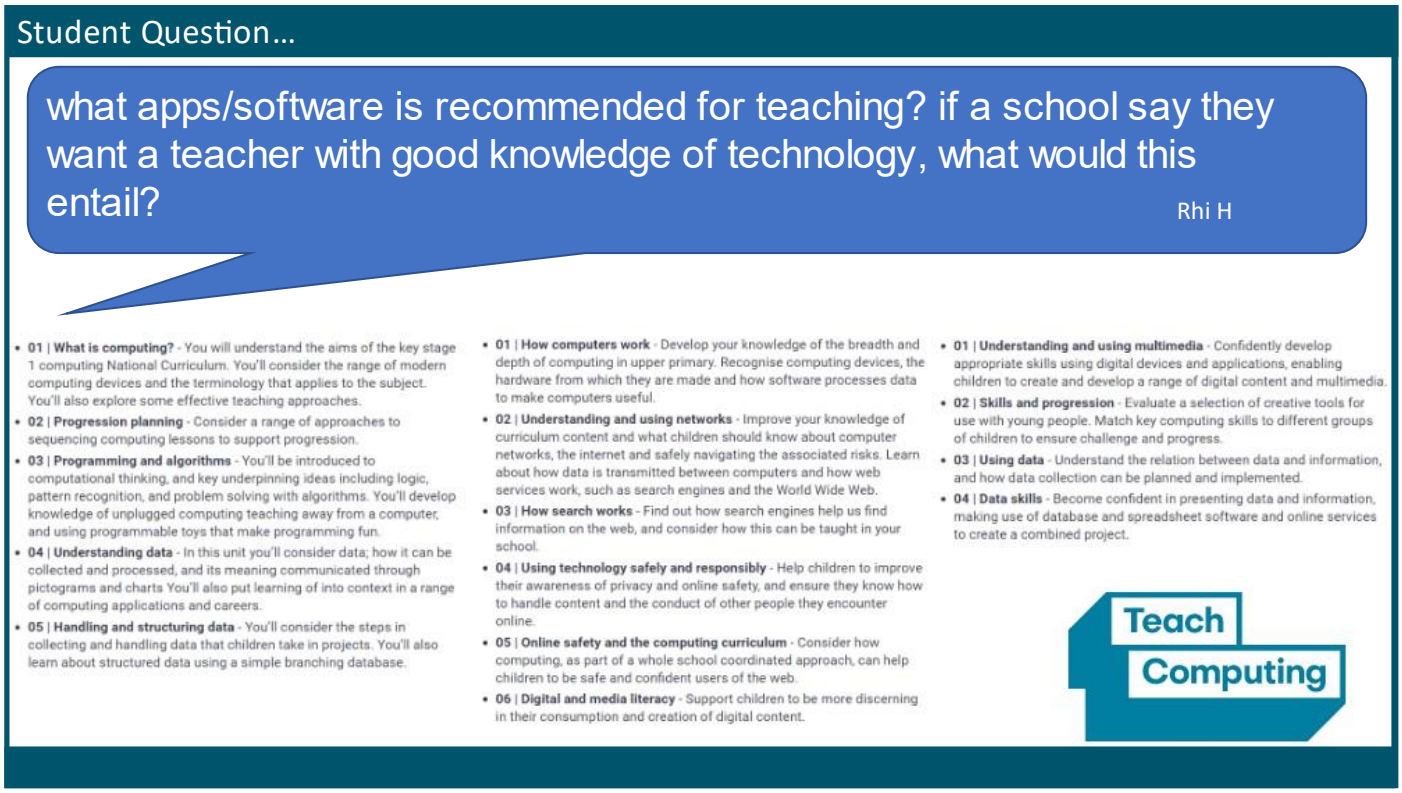
What should children know / what skills should they have to prepare them for secondary school?

Rebecca H

Primary Computing > End of year Age Related Expectations > Year 6

e-Safety	Coding	Information Science	Digital Literacy	Computational Thinking
I can protect my password and other personal information.	I can deconstruct a problem into smaller steps, recognising similarities to solutions used before. TT6.11	I can plan the process needed to investigate the World around me.	I can talk about audience, atmosphere and structure when planning a particular outcome.	I can tell you the Internet services I need to use for different purposes.
I can explain the consequences of sharing too much about myself online.	I can explain and program each of the steps in my algorithm.	I can select the most effective tool to collect data for my investigation.	I can confidently identify the potential of unfamiliar technology to increase my creativity.	I can describe how information is transported on the Internet. TT6.1
I support my friends to protect themselves and make good choices online, including reporting concerns to an adult, inside or outside school. TT6.7	I can evaluate the effectiveness and efficiency of my algorithm while I continually test the programming of that algorithm. TT6.10	I can check the data I collect for accuracy and plausibility.	I can combine a range of media, recognising the contribution of each to achieve a particular outcome.	I can select an appropriate tool to communicate and collaborate online. TT6.2
I can explain the consequences of spending too much time online or on a game.	I can recognise when I need to use a variable to achieve a required output. TT6.12	I can interpret the data I collect.	I can tell you why I select a particular digital tool for a specific purpose. TT6.3	I can talk about the way search results are selected and ranked. TT6.9
I can explain the consequences to myself and others of not communicating kindly and respectfully.	I can use a variable and operators to stop a program. TT6.13	I can present the data I collect in an appropriate way.	I can be digitally discerning when evaluating the effectiveness of my own work and the work of others.	I can check the reliability of a website. TT6.8
I protect my computer or device from harm on the Internet. TT6.6	I can use different inputs (including sensors) to control a device or onscreen action and predict what will happen.	I use the skills I have developed to interrogate a database.		I can tell you about copyright and acknowledge the sources of information that I find online.
	I can use logical reasoning to detect and correct errors in algorithms and programs. TT6.14	TT6.5 I can use software to help me analyse and present data and information.		TT6.4 I can create an 'app', website or digital resource for a specified audience.

In terms of transition or getting ready for Secondary School, my ideal would be that by the end of Year 6, the CREST and Arts Awards certification are an externally validated recognition of these skills along with children starting their journeys on the iDEA programme which is the Inspiring Digital Enterprise Award – the digital equivalent of the Duke of Edinburgh's Award scheme. I would also want or expect children by the end of Year 6 to be keyboard proficient with a speed of between 10 and 20 words per minute and accuracy of above 60 percent. I base these ideas on the notion that this would perfectly prepare them to seriously consider electing Computing at GCSE based on my experiences this year of teaching A-Level Computer Science.



For those who are either interested in taking on or been invited to the role of Computing Lead, the National Centre for Computing Education as well as the Computing at Schools Network have a wealth of resources as well as training or CPD support. For those already working in Schools, that training has been (2020 and 2021) funded through bursaries and your Schools may also qualify for funds to cover your absences to attend. For those who might not have that aspiration, the training offered is I think still invaluable to ensure all teachers have a secure subject knowledge.

[Presentation and speaker notes continue on the next page]

Finally to say, From my time working in schools I know first-hand that there will be experiences which may frustrate you. However, I know too that these will be outweighed by the pure joy and exhilaration as you take the learners you are tasked to work with on a life-long journey of light bulb moments where they become encouraged and inspired by everything you teach them. I for one am really excited that you are my future colleagues with some becoming sufficiently senior and potentially becoming my direct or indirect boss. You never know. Hopefully we will continue to remain in contact through social media or get to meet each other again through the various professional networks that exist in the real World. I wish you all the very best for the rest of your professional journeys that you have embarked on. Thank you for reading.

…continue the conversation…

@WillowBrookGST @TsuiAllen

Centre image thanks to @jonwittsand @QueenMargarets

All Internet references last accessed: 29 April 2021

Micro:bit Educational Foundation
https://microbit.org/

National Curriculum in England: computing programmes of study
https://www.gov.uk/government/publications/national-curriculum-in-england-computing-programmes-of-study/national-curriculum-in-england-computing-programmes-of-study

Computing at Schools Network
https://www.computingatschool.org.uk/

National Association of Advisers for Computing in Education
https://www.naace.co.uk/

Royal Society Schools Network
https://royalsociety.org/topics-policy/education-skills/teacher-resources-and-opportunities/schools-network/

UK Council for Internet Safety
https://www.gov.uk/government/organisations/uk-council-for-internet-safety

National Centre for Computing Education
https://teachcomputing.org/

BCS: The Chartered Institute for IT
https://www.bcs.org/

National STEM Learning Centre
https://www.stem.org.uk/

Raspberry Pi Foundation
https://www.raspberrypi.org/

Gender Action
https://www.genderaction.co.uk/

Schemes of Work suggestions

Kapow Primary (available for individuals to purchase subscriptions)
https://www.kapowprimary.com/

ilearn2 (available for individuals to purchase subscriptions)
https://www.ilearn2.co.uk/

Twinkl (not Computing specific. Resources are useful)
https://www.twinkl.co.uk/

PurpleMash (subscription only available through Schools)
https://www.purplemash.com/login/

Switched On Computing by Miles Berry (Twitter: @mberry)
https://www.risingstars-uk.com/series/switched-on-computing

London Grid for Learning Computing Resource Centre
https://www.lgfl.net/learning-resources/computing-resource-centre/default.aspx

Just2Easy
https://www.j2e.com/

Kano
https://kano.me/uk

Vex Go
https://www.vexrobotics.com/go

Barefoot Computing
https://www.barefootcomputing.org/primary-computing-resources

Staying Safe Online recommendations

Better Internet for Kids
https://www.betterinternetforkids.eu

Childnet International
https://www.childnet.com/

Internet Matters
https://www.internetmatters.org/

Internet Watch Foundation
https://www.iwf.org.uk/

National Online Safety
https://nationalonlinesafety.com/

Parent LGfL Online Safety
https://www.lgfl.net/onlinstaying safe online/resource-centre?s=16

Parent Zone
https://parentzone.org.uk/

South West Grid for Learning
https://swgfl.org.uk/

Think U Know
https://www.thinkuknow.co.uk/

UK Safer Internet Centre
https://www.saferinternet.org.uk/
SafeToNet
https://safetonet.com/en-gb/

#BeInternetLegends with GoogleUK
https://safetonet.com/en-gb/

#Becybersmart: A collaboraton established in 2021 between BT, Barefoot Computing, Computing at Schools Network with the National Crime Agency
https://safetonet.com/en-gb/

NSPCC Keeping Children Safe online safety
https://www.nspcc.org.uk/keeping-children-safe/online-safety/

Coding or Programming apps and website suggestions taken from this short-list
https://www.commonsense.org/education/top-picks/best-apps-and-websites-for-learning-programming-and-coding

Root Coding
https://edu.irobot.com/

Kodeable
https://www.kodable.com/

code.org
https://code.org/

Spritebox
https://spritebox.com/

Code for Life
https://www.codeforlife.education/

Sphero Edu
https://sphero.com/

Tynker
https://www.tynker.com/

Microsoft Make Code which includes **micro:bit** and **Minecraft Education**
https://www.microsoft.com/en-us/makecode

Google CS First
https://csfirst.withgoogle.com/s/en/home

Unity (for those who are working at an advanced level and ready to be coding to a commercial standard with a good gaming storyline idea)
https://learn.unity.com/

Codecademy (for those who are ready to move from block coding to text based programming)
https://www.codecademy.com/

Lightbot
https://lightbot.com/

Scratch Jr (free but only available as an app from Google Playstore or Apple Apps Store)
https://www.scratchjr.org/

Scratch
https://scratch.mit.edu/

Sam Labs
https://samlabs.com/uk/

Wonder Dash
https://uk.makewonder.com/dash

Lego WeDo
https://education.lego.com/en-gb/products/lego-education-wedo-2-0-core-set/45300#wedo-20-core-set
The most expensive but one of the best products for teaching physical computing.

Code Club
https://codeclub.org/en/

Externally validated certification schemes with direct links to Primary Computing

British Science Association CREST Awards
https://bsa.fluidreview.com/

Arts Award
https://www.artsaward.org.uk/site/?id=64

inspiring Digital Enterprise Awards
https://idea.org.uk/