

SAPIENTIA

From ICT for Education

Everything you need to know about Computing, the curriculum, and the classroom

Welcome to Sapiencia, ICT for Education's termly newsletter written by education specialists for professional colleagues across the sector. The newsletter offers thought leadership, an insight into hot topics, and practical guidance on how to implement new technologies and techniques to improve teaching and learning.

This edition of Sapiencia leads with an article by **Miles Berry, Professor of Computing Education at the University of Roehampton**. Berry discusses the lack of diversity in computing and how it could be addressed, including schemes designed to increase the mix of students studying the subject, teaching approaches such as peer instruction, pair programming and storytelling, a focus on the relevance of computing, and consideration of potential career opportunities.

He also notes the challenges of taking part in computing, with some students not being given the opportunity to take the subject, and perhaps, the lack of a broad qualification holding others back. Despite these and other issues, Berry says it is worth exploring role models and examples, and suggests former pupils and diverse individuals working locally in creative or tech related industries may provide inspiration and an understanding of the relevance of computing for all.

A second article in the summer edition of Sapiencia is written by **Allen Tsui, subject lead for primary**

computing at Willow Brook Primary School Academy and a part-time student on the MA in STEM Education programme at King's College London. He reports on the British Science Association's Science Week 2024 and the Intelino #Engineuity STEM Challenge he designed and that has since become a CREST Discovery Award 'STEM in a Day' accredited resource.

Intelino is a supplier of a smart train that uses next-generation technology to elevate playtime experience and it is this, says Tsui, that makes the Intelino #Engineuity STEM Challenge particularly suitable and engaging for upper primary students and those transitioning to secondary school. The challenge enables students to apply computational thinking skills to construct a simple closed loop network for the train engines. Such an activity, he concludes, enables learners to demonstrate their Royal Academy of Engineering capabilities. Enjoy!

To keep pace with the changes, challenges and opportunities in the primary and secondary education sectors, register for ICT for Education's termly newsletter here or e.mail il@ictforeducation.co.uk.

Sarah Underwood, Editor - ICT for Education

Diversity in Computing

By Professor Miles Berry, Professor of Computing Education at the University of Roehampton

We are nearing the 10th anniversary of computing becoming part of the national curriculum, which meant coding and computing would be taught to all pupils irrespective of their gender, ethnicity or home background. This inclusive vision for the subject has served us well, with close on 100% of pupils learning at least until the end of Key Stage 3.

However, when pupils are given the option to choose the subjects they study for GCSEs and A-Levels, computing does not do well. The situation is improving: this year, entries are up 6.2% and 11.8% respectively, but there's an ongoing issue around under-representation of some groups of pupils. Put simply, when given the choice, girls,

poorer pupils and some ethnic groups are much less likely to choose to study computer science, and some pupils in these groups are not even given the chance to do so.

Last summer, just 21% of GCSE entries were from girls and 15% of A-level entries. For schools in the 20% of most affluent areas, 92% entered pupils for a GCSE in computing last summer. In the 20% of least affluent areas, this dropped to just 64%. One consequence of this is that 16% of pupils in these most affluent postcodes did the GCSE, but only 10% of those in the poorest areas did. Computing is a very meritocratic field and offers lots of opportunity to address social mobility – it seems wrong that pupils who would most benefit from the opportunity to study this at GCSE are denied the opportunity to do so.

I am aware that I come to this from a position of some privilege, as a white, middle-class, middle-aged man, but the unrepresentative nature of GCSE and A-Level computer science matters profoundly to me, as it should to us all. Partly, this is because I think everyone should continue to study some aspects of computing until they leave school, given the impact of computing on other academic disciplines, all jobs, culture and society. It is also because computer science opens up lots of career opportunities for those who do study it. More than this, those who work in tech ought to be more representative of the society they're building tech for. If not, there's a real danger that the products we get are based too much on the needs and opinions of unrepresentative groups – as we're seeing with the misuse of AI.

There are many possible reasons for why diversity in computer science isn't all that it could be, but it is certainly not because it's a 'boys subject' – the first programmers were women, women make up more than 50% of those studying computer science in Arab world universities, and girls get better grades than boys in both GCSE and A Level computer science.

In part, the disparity is because some pupils aren't even given the opportunity to take the subject. This could be because there just aren't enough computing teachers to go round, and it might be that it's even harder to recruit computing teachers in economically disadvantaged areas than in more affluent ones. I think there are also potential issues with the nature of the subject itself – ICT, for all its faults, had a much more diverse cohort than computer science has. I would love to see GCSE and A-Level computer science replaced by far broader qualifications in computing that recognise the full breadth of the national curriculum subject and take in the most useful bits of coding and computer science, alongside useful skills in IT

and digital media, and critical digital literacy to help pupils think hard about the impacts of digital technologies. A broader qualification would be likely to broaden the uptake.

My 13-year-old daughter put it very well: “The boys are interested in what computers can do, the girls are interested in what we can do with computers.” This seems to reflect many of the opinions in the DfE’s Omnibus survey last summer and the recently published Science Education Tracker. The latter reveals a disturbing decline in pupils’ interest in computing from Year 7 to Year 11, particularly among girls, and the numbers in the 2023 report are even worse than they were back in 2019. Digging into this data, the girls who choose to study computing often say they find it creative, those who don’t often say it’s because it’s not interesting, not enjoyable or just too difficult – there are lessons to learn here for how the computing qualifications should be reformed.

Other than broadening the scope of the qualifications, what else might be done? The Raspberry Pi Foundation conducted research into a number of strategies: developing non-formal learning of computing; promoting a sense of belonging for girls; focussing on the relevance of computing; working on teaching approaches such as peer instruction, pair programming and storytelling, and work on option choices and how the subject is promoted at this point. These are all really good ideas and well worth considering in school. Alas, the research was conducted during the pandemic and didn’t indicate that any one of these strategies made a statistically significant impact, but perhaps a combination of strategies might.

The National Centre for Computing Education has developed an ‘I Belong’ project, addressing how computing can be better promoted to girls in Key Stage 3, which seems crucial to see impact on subsequent GCSE choices.

Before 2010, Becta developed a home access scheme, providing free computers and internet access to pupils entitled to free school meals. This was a great success, but it was stopped when the incoming government closed Becta. However, there’s nothing to stop schools using some of the Pupil Premium funding now available to provide laptops and internet access to pupils who don’t have these, as items ‘necessary to overcome specific barriers to pupil attainment’. If we’re serious about addressing the socioeconomic divide in computing education, and education more generally, it’s hard to think of something that would have a better return on a relatively modest investment.

Culturally responsive teaching might do much to help pupils from under-represented ethnicities see computing as something for them. Again, the Raspberry Pi foundation has done much here, building on work conducted in the US. The approach includes using learners' own cultural knowledge and experiences to inform what we teach and providing opportunities for learners to pursue personally meaningful projects to express their own identities.

For all of these issues, it is worth exploring the role models and examples. Many pupils in these groups might not be able to see themselves in tech or tech-related roles. Brilliant as Grace Hopper, Ada Lovelace, Mary Jackson and Tommy Flowers were, pupils might not easily be able to see them following in their footsteps. Former pupils and diverse individuals working locally in creative or tech related industries might be much better at inspiring pupils and demonstrating the relevance of computing for all.

Register to meet and hear Miles speak at the [ICTfE Brighton Conference on June 16th at The Amex Stadium.](#)

Plus a further opportunity to meet Miles when he speaks at the [ICTfE Aston University Seminar on June 25th.](#)



Professor Miles Berry

Miles Berry is Professor of Computing Education at the University of Roehampton. Before joining Roehampton, he spent 18 years in schools, including a period as a head teacher. He has contributed to a wide range of computing projects, including the computing programmes of study in the National Curriculum, Barefoot Computing and Switched On Computing. He serves on the boards of Computing At School, the BCS Academy of Computing, and the National Centre for Computing Education, and is a regular keynote speaker and international consultant on curriculum and professional development. He is @mberry on Twitter and find out more on milesberry.net

Intelino #Engineuity STEM Challenge

By Allen Tsui, Subject Lead for Primary Computing at Willow Brook Primary School Academy

Despite consternation over the state of schools, pay relative to living costs and excessive workloads faced by teachers, working with Vivita Sequeira, a teacher of Computer Science at Channing School, and presenting a day-long set of workshops on the Intelino #Engineuity STEM Challenge created by yours truly, reminded me how much I absolutely love teaching Computing.

Being a part-time student on the MA in STEM Education at King's College London has turned into quite a challenge since the start of this calendar year as I'm literally not quite hitting the mark as it were. I am realising though, from all of the academic reading I have been doing, that I am of the view (which is an entirely privately held perspective) that STEM education is an artificial, politicised construct. This is neither the time nor place to explain, but what I do want to say is that despite this viewpoint, the 10-day celebration of British Science Association's Science Week 2024 was epic as the Intelino #Engineuity STEM Challenge I designed has since become a CREST Discovery Award 'STEM in a Day' accredited resource. Intelino is a supplier of a smart train that uses next-generation technology to elevate the playtime experience.

#BSW24 as it has become known on Twitter / X was doubly epic because of the Micro:bit Educational Foundation that launched its #BBCPlaygroundSurvey collaboration with the Office of National Statistics. The donation of next-generation micro:bits to primary schools has meant I have been travelling around my home ground in North London presenting workshops on behalf of Digital Schoolhouse to introduce classes in schools other than my own, as well as colleagues across the wider school community, to the beauty of the micro:bit.

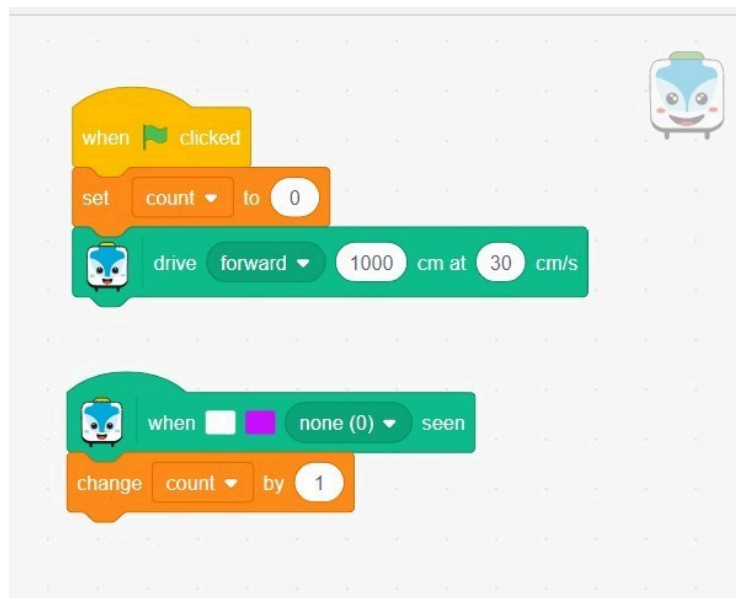
For my own school, using the short and simple sequence of blocks to make use of the micro:bit accelerometer and data from the children's step counter, we were able to create and code that it is possible to harness kinetic energy from our footsteps. The children at my school could make a household lightbulb shine for approximately half an hour based on 30 minutes of aerobic, foot-stamping activity.

It has been the learning through play effect of the Intelino that has had an impact. Seeing the students' excitement as they construct the track layout I provide them with and their beaming smiles at the 'eureka' moment as they first place the Intelino engine on the track and activate its automated motion. A forensic analysis of the statements or learning outcomes used by many schools to track learner progress with exemplars of activities using the Intelino shows how versatile it is while meeting parts of the National Curriculum in Science that other programmable products simply cannot teach.

Specifically for upper primary and those making the transition to secondary school, the Intelino #Engineuity challenge enables students to apply their computational thinking skills by constructing a simple closed loop network for the engines to run on. They are then also able to consider the colour sensor properties of the Intelino engines, describing the actions the engine performed from each of the sequence of coloured sleep style 'snaps' tiles the students arranged on the tracks in a timed challenge.

Intelino's ability to connect to other toy or model train systems meant being able to create or design a puzzle to retrieve a cargo of chocolate from a segment of tunnel. Such an activity enables learners to demonstrate their Royal Academy of Engineering habits and engineering mind attributes.

Collaboration with Intelino since November 2023 means being able to teach a wide range of programming constructs – specifically sequencing, variables, selection and iteration applied in a real-world context as network engineers to design a public railway service. Students are expected to apply their arithmetic skills to calculate the circumference and perimeter of the 'stadium' layout as well as their understanding of Newton's laws of motion. They can also practice their understanding of probability theory by testing how random the Intelino 'snaps' are by using this very short and simple sequence of scratch.intelino.com block code:



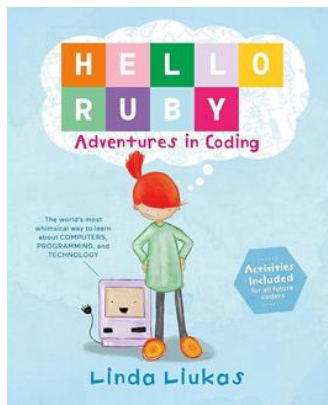
Given the versatility and potential of Intelino to integrate Computing and Mathematics to enable children as young as aged three to demonstrate their abilities to work scientifically and bringing real world engineering experiences of designing a public railway system with such a playful approach, a return ticket aboard the Intelino to STEM must be on every educator's bucket list.



Allen Tsui

Allen Tsui is Subject Lead for Primary Computing at Willow Brook Primary School Academy, where he specialise in teaching Computing to children as young as aged 3 (Nursery and Early Years) to 11 year olds (Year 6).

Recommended reading



Professor Miles Berry, of Computing Education at the University of Roehampton recommends:

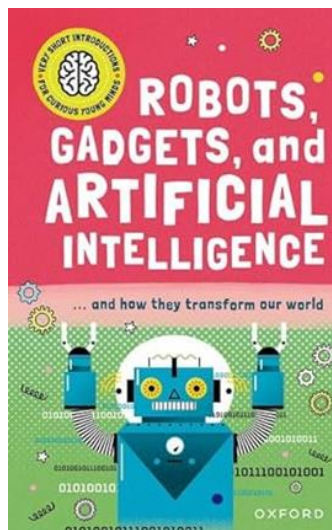
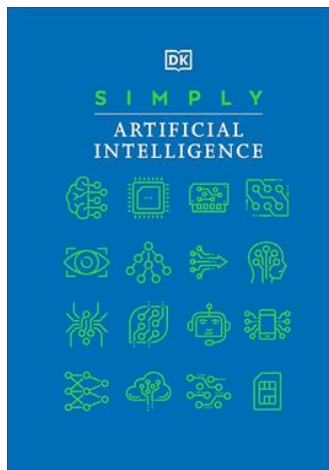
"Hello Ruby: adventures in coding" by Linda Liukas (Vol. 1). Macmillan.

Half storybook, half activity guide, this book covers Ruby, a small girl with a huge imagination, and her adventures to discover some of the big ideas that underpin computing.

Miles also recommends:

"Agent Asha: mission shark bytes." by Sophie Deen and illustrated by Anjan Sarkar from Walker Books..

A captivating story about young spy Asha Joshi and her use of coding to save the world.



Allen Tsui, Subject Lead for Primary Computing at Willow Brook Primary School Academy recommends:

“Simply Artificial Intelligence” by Hilary Lamb, Joel Levy and Dr Claire Quigley was originally published in 2023 so potentially some of the ideas might have been superseded but nevertheless provides a great starting point for those interested in developing a greater understanding of all that is being said about AI. This book is a great glossary of extremely accessible ideas and concepts which underpin Artificial Intelligence. (Aimed at audience with a reading age 10+)

“Robots, Gadgets, and Artificial Intelligence” by Tom Jackson and Dr Vaishak Belle takes a more story telling, narrative approach through the history of technology, making technical ideas tangible and drawing on current concepts to enable readers to form their own ideas for the future.

Learn, Share, Enjoy

ICT for Education can help you get the most out of technology in your classroom and in your school. Our free to attend conferences and seminars provide relevant, innovative, informative content delivered by experienced, knowledgeable, respected speakers able to relate to and understand the challenges faced by those responsible for giving learners the best opportunities in life.

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Brighton - 14/06/2024

Newcastle - 20/09/2024

Salford - 10/10/2024

Birmingham - 08/11/2024

Reserve your conference place



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St James' Park, Newcastle

Attend a Seminar

Aston University - 25/06/24

Coventry University - 10/09/24

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Aston University, Birmingham



Coventry University

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