A SUMMARY OF

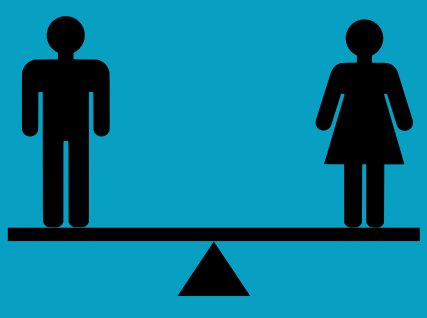
Ofsted's Computing Research Review

Primary

Pupils gain a foundation in the key attitudes, knowledge and skills that provide later success in the subject. Despite some of the content appearing difficult, young pupils can tackle key knowledge with effective teaching. Teacher subject knowledge can be a barrier to effective teaching and learning in primary schools, as very few primary teachers have a computing qualification.

Secondary

Pupils need to be taught computing up to KS4, although those not taking computing qualifications often receive little taught curriculum time. An hour a week of computing is insufficient to teach the content of the KS3 curriculum. Recruitment of qualified computing specialists is a challenge for schools.



Gender

Gender is the biggest diversity issue in the subject. Despite girls outperforming boys, far fewer girls take the subject to A-level. Reasons for differences include reports of lack of interest, perception of the subject as boring, and low levels of confidence. Both boys and girls underperform in computing qualifications compared to their other subjects.

Workforce

There is a lack of qualified computing teachers throughout the sector and especially in primary. Subject knowledge and pedagogical content knowledge affect the overall quality of teaching. It is difficult to recruit specialist teachers into the profession, likely due to the difference in salary potential for computing graduates. The importance of CPD for teachers, in both primary and secondary, cannot be overstated.

Pillars of Progression

The three main content areas are: computer science, information technology and digital literacy. These are noted in the National Curriculum and should be understood as being interconnected, rather than separate entities within the curriculum. Knowledge in one pillar can affect knowledge acquisition in another.

Types of Knowledge

Computing consists of both **declarative** and **procedural** knowledge. Declarative knowledge is **knowing that** and procedural knowledge is **knowing how**. Declarative knowledge includes knowledge of facts, concepts and how these are related. Procedural knowledge consists of knowledge of methods and processes. Again, these two types of knowledge are related such as understanding why each step in a process happens.

Computer Science

This covers knowledge of computers and computation including data, system architecture, algorithms and programming and it is the core of computing, underpinning the whole subject. It provides the foundational knowledge required to understand and interpret the other areas of the computing curriculum. Computing curricula should therefore be rich in computer science knowledge.

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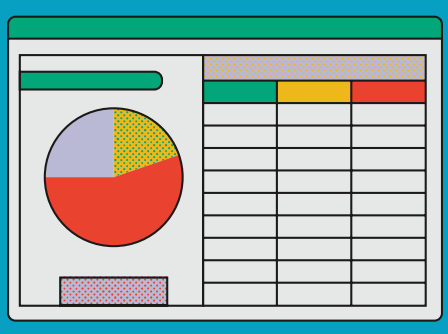
Computational Thinking

Computational thinking is when pupils solve problems in computing. Using the definition of computational thinking as an 'approach to solving problems in a way that can be implemented with a computer' can be helpful when designing a curriculum. Elements of computational thinking which should be included in the curriculum consist of: logic and logical thinking; algorithm and algorithmic thinking; patterns and pattern recognition; abstraction and generalisation; evaluation; and automation.



Information Technology

Knowledge in this pillar refers to digital artefacts and computing contexts. Digital artefacts are the digital objects made by humans. Pupils need to acquire both declarative and procedural knowledge of how to create digital artefacts. Computing contexts refer to the knowledge about how computing has played a significant part in our history and how it can transform our daily lives. This is classed as 'empowering knowledge'.

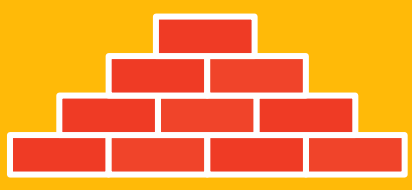
Digital Literacy

This pillar of progress consists of the knowledge pupils need to use digital devices safely, effectively and discerningly. Adults should not assume pupils are digital natives; pupils need to be taught how to use the devices intended by the curriculum. e-Safety should be carefully planned so that pupils learn age-appropriate content, building on prior knowledge.

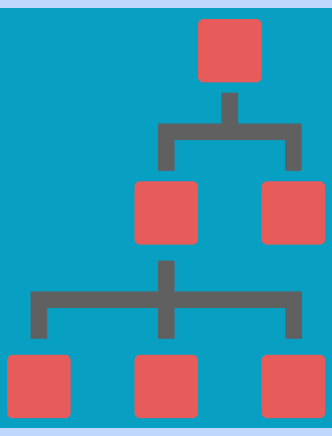
Programming

Programming is an important concept within the primary curriculum. It allows pupils to apply their knowledge of computer science through writing code to solve problems. Learning to program can be difficult when required to learn many things at once. Pupils should also be taught to develop a mental model of the programme they are working with - a notional machine. This can be achieved through teaching the declarative knowledge which supports their understanding of the code they are writing.

Block-based Programming



Block-based programming - such as Scratch - is commonly used in primary settings and can be useful to introduce coding to younger pupils. It is important for teachers to recognise that block-based programming can create some misconceptions and habits which make success at a later stage more difficult. These can be avoided through considering how the blocks are taught and how pupils understand the wider goals of the algorithms they are coding.

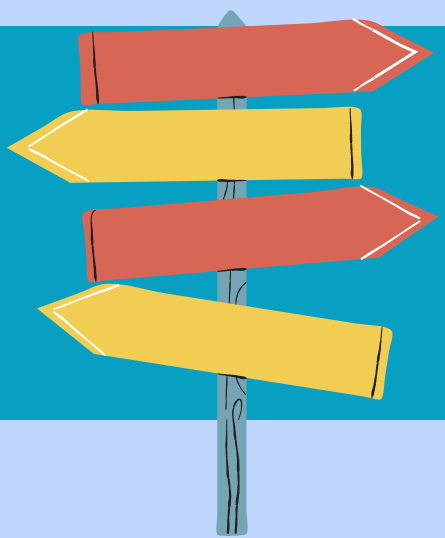


Curriculum Sequencing

It is not feasible to teach all possible knowledge and so the approach to sequence depends on the knowledge which is selected as part of the curriculum intent. Teachers should treat this knowledge as hierarchical and use this to hierarchy to guide the sequencing of the content. Many aspects of computing are composite tasks and these should be broken down into the component knowledge which pupils require to be successful (see assessment).

Pedagogy

Many aspects of computing have a high intrinsic load meaning that there is often a lot to think about, increasing the risk of cognitive overload. Teachers should teach pupils as novices, breaking down the knowledge into sufficiently small steps. The appropriateness of teaching approaches depends on the pupils' proficiency. The vast majority of school-age pupils lack the ability to acquire the knowledge in an unguided way.



Worked Examples

Worked examples are effective scaffolds to help pupils solve the many types of problems which they will face in the computing curriculum. The effectiveness of worked examples depends on the prior knowledge of the pupils: they become less effective the more a pupil knows. Worked examples can be labelled with subgoals to help pupils break down a complex task into smaller, more achievable units.

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Unplugged Activities

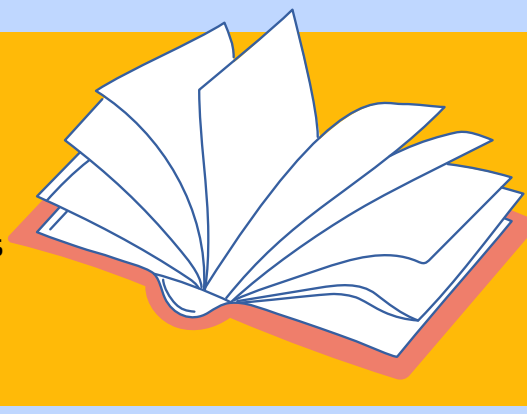
Unplugged activities are those which teach elements of the computing curriculum without using a computer. They can be useful when introducing new knowledge but can also introduce misconceptions. The report advises teachers to consider the appropriateness of any task in terms of achieiving the curriculum goals.

Storytelling

The human brain is wired to learn from stories, as they are 'psychologically privileged'. Telling stories can support memorisaton as well as being able to provide examples of concepts in computing. If stories and analogies are used, they should always be linked back to the computing concept they are being used to introduce or illustrate.

Textbooks

High-quality textbooks can be effective and supportive for both teachers and pupils. This is especially true when teachers have weaker subject knowledge.

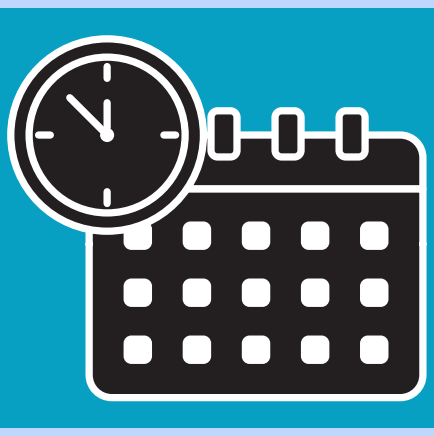


Assessment

Assessment should be based on determining what pupils have remembered and how able they are to apply their knowledge. It is advised that assessment be focused on component knowledge rather than generic competencies or composite tasks. This allows teachers to identify the success of the intended curriculum as well as track pupils' achievement in accordance with their curriculum goals.

Teacher Subject Knowledge

The lack of subject specialists is an issue for the sector, especially in primary. Subject-specific CPD varies widely from school to school, despite subject knowledge being a key aspect of effective teaching. It is also important to develop teachers' pedagogical content knowledge (knowledge of how pupils learn the content they are being taught). Investing in subject knowledge should increase the success of designing and teaching a high-quality curriculum.

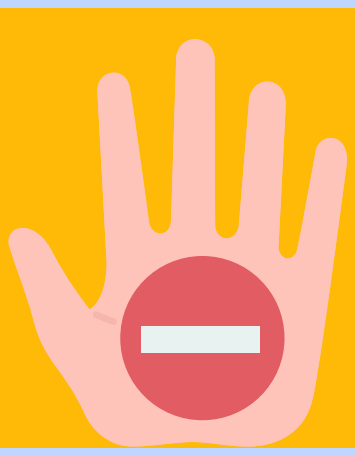


Timetabling

The typical time given to computing is insufficient to teach the National Curriculum content. Reducing time increases **teachers' workload;** they need to meet the same requirements of the curriculum within a smaller time frame or deliver a diminished curriculum. It is suggested that less than an hour a week in KS3 is inadequate to meet the requirements of the National Curriculum.

Infrastructure

Teachers may be required to use specialist software and hardware in order to provide an ambitious computing curriculum. Using this equipment can often be at odds with maintain network security and performance in schools. This creates a tension which needs to be addressed. It is important to manage risk appropriately so that the controls in place do not unnecessarily restrict the enacted curriculum.



This is a very condensed summary of the research review conducted by Ofsted into high-quality Computing curriculums. I have provided a more detailed summary on my website which explores these themes in more detail, though I would definitely recommend reading the entire review and accessing some of the materials on Ofsted's YouTube channel. All links are on my website.

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