# Primary Initial Teacher Education: Curriculum Plan

## Computing: Undergraduate Programmes

**Curriculum Intent:**

*Through our Initial Teacher Education Curriculum, it is our intention that trainees:*

* *receive sufficient grounding in subject knowledge to be able to teach KS1 and KS2 National Curriculum Computing three strands of Computer Science, Information Technology, Digital Literacy and to form the basis for additional subject knowledge development and enhancement (****LH3.1****).*
* *develop an understanding of why Computing is in the National Curriculum and why it is important to provide this opportunity for children to learn about Computing.*
* *apply their subject knowledge to planning, teaching, learning and assessment for classroom practice for training and beyond to ensure appropriate progression.*
* *develop knowledge and understanding of pedagogical approaches for teaching Computing at KS1 and KS2 and adopt a critical approach towards these.*

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| **Phase** | **Learn that…** | **Learn how to…** |
| **Phase 1** | **Trainees will know:**  | **Trainees will be able to:**  |
| The importance of Computing in society and the opportunities this affords children; their role, as teachers, to open these opportunities for all children. | Use software beyond typical office applications which can be used for creative computing, for example: animation, collaborative tools (Google docs, OneDrive). |
| The fundamentals of what a computer is, how it works, how it stores, processes and sends information. | Read code and predict what it will do using logical reasoning. |
| How computational thinking underpins computer science: problem solving, design and implementation of computer systems (virtual and physical devices).  | Modify, make and debug programs  |
| Common input/ output devices. | Physical devices, such as robots or microprocessors can be programmed including the use of sensors (input), motors, LEDs, buzzers (outputs), etc (e.g. Ozobots, Codebug, Microbit, Crumble). |
| That binary is used to store, process and send data in a computer system. | Design and implement a program independently. |
| The programming concepts sequence, selection, repetition and variables and how they apply in a range of different programming contexts. | Evaluate unplugged approaches to teaching computational thinking (**LH3.5, LH3.6, LH3.7**) |
| Computational thinking includes decomposition, algorithms, pattern recognition, abstraction and logical thinking. | Plan a computer science lesson which demonstrates progression for all learners (**LH2.4, LH3.20, LH4.14**) |
| Selecting appropriate pedagogical strategies can aid cognitive load, retrieval and long-term memory, including purposeful practice, spaced learning and scaffolding and fading (**LT2.1, LT2.4, LT2.7, LT2.8**) |
| **Trainees will understand:**  | **Composite knowledge/understanding/skills***By the end of this phase trainees will* ***know:**** how to read code;
* how to design and write a program; and
* pedagogical strategies for teaching computer science to KS1 and KS2 children.

*By the end of this phase trainees will* ***understand:**** Computing is a separate discipline which is still relatively new and developing, although the underlying principles remain the same.
* Computational thinking underpins computer science and problem solving within computing (and beyond).
* Testing, debugging and collaboration are fundamental aspects of computing. Computing teaches children they cannot always get learning right the first time, so they need resilience, perseverance, creativity and a willingness to collaborate with others. (**LH1.3**)

*By the end of this phase trainees will* ***be able to:**** plan appropriately to teach computer science at KS1 and KS2

Formative assessment: Trainees will:* Modify a programming project (tutor observation)
* Work collaboratively to program physical computing devices (tutor observation)
* Participate in retrieval activities (tutor observation and questioning)
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| Programming, and related activities, require resilience, perseverance, risk-taking, innovative-thinking, collaboration and recognition that we will probably not get it right the first time; debugging and testing are essential parts of the process. (**LT4.5, LT7.4**) |
| Cross-curriculum teaching with technology (TEL) does not meet the National Curriculum for Computing, unless there are specific learning objectives for Computing curriculum included; teachers should exploit cross-curriculum opportunities by planning learning for both subjects.(**LT3.4**) |
| Computing is integrated into society and there are significant opportunities for those who can work in this field. Computing requires a more diverse workforce. |
| That an understanding of the fundamentals of computing is required to take part, as an informed citizen, in ethical and moral debates about technological issues (e.g. artificial intelligence, driverless vehicles, algorithms used to make decisions on our lives, data collected, held and processed by organisations). |
| Computational thinking is a way of thinking, specific to computing, to make it easier to solve problems, think through solutions and create systems. |
| Computational thinking can be taught explicitly through a range of pedagogical approaches and should become embedded in practice as children design and program their own systems. |
| The input, process, storage, and output modelRecognise the model (opposite), the functions of a computer and be able to explain each element. |
| **Research**: Evaluate and demonstrate awareness of current computer science pedagogy and research into developing computer science pedagogy, including through engagement with Sentance et al (2019) ‘Teaching computer programming with PRIMM: a sociocultural perspective’. *Computer Science Education*. 29 (2-3), pp. 136-176. (**LT3.3, LT3.5, LT4.2, LT4.3, LT4.4, LT4.7, LT4.8, LT4.9, LT5.1, LT5.3, LT8.2)** |
| Lesson Planning must take into consideration children’s current knowledge, understanding and skills of the subject, as well as their emotional and cognitive development, and be adapted accordingly (**LT1.3, LT2.2, LT5.1, LT6.6**) |
| **Phase 2** | **Trainees will know:**  | **Trainees will be able to:** |
| How information is sent across networks | Use software beyond typical office applications which can be used for creative computing, for example: animation, sound editing, digital art, data handling (branching databases, flat file databases, spreadsheets), collaborative tools (Google docs, OneDrive), and their use in the classroom.  |
| Data is split into packets to allow it to be sent across a network. | Plan a sequence of lessons using Computing through a cross-curriculum project theme (**LH2.4, LH3.20, LH4.14)** |
| Networks use a range of devices, including routers, modems, switches, cabling, wifi, servers. |  |
| The Internet is the largest network and is the hardware/ infrastructure which allows us to access the World Wide Web. |  |
| Cloud computing refers to large data warehouses which allow us to access and send data, wherever we are, via multiple devices. |  |
| The World Wide Web are services which run on the Internet (software), such as email, websites, social networking sites. |  |
| Search engines use algorithms which influence the results of our searches and the order in which results are displayed. |  |
| Searches can be made more efficient by using specific terms, alternative terms, Boolean operators, wild card characters, quotation marks, etc. |  |
| Children can use child friendly search engines. |  |
| There are risks, responsibilities and opportunities when children are online. Risks can be identified as content, contact and conduct risks which will vary according to age and activity. |  |
| Plan and design an effective cross-curriculum project for teaching Computing which will enable all children to make progress across a sequence of lessons. ((**LT1.3, LT2.2, LT2.6, LT4.4, LT4.6, LT4.7, LT4.8, LT4.9, LT4.10, LT5.1, LT6.6)**  |  |
| **Trainees will understand:**  | **Composite knowledge/understanding/skills***By the end of this phase trainees will* ***know:**** Efficiency and effectiveness are key drivers in Computing (e.g. making programs more efficient, using the correct software / hardware for the task at hand) and hardware and software should be critically evaluated for their usefulness and appropriateness to the task.

*By the end of this phase trainees will* ***understand:*** * Cross-curricular contexts are important for teaching the IT strand, yet computing objectives must be planned and met
* The requirements for e-safety education are progressive across the age phases;
* E-safety teaches children to stay safe and responsible online in school and out of school.

*By the end of this phase trainees will be* ***able to:*** * be able to plan for progression across a sequence of lessons using cross-curricular approaches

Formative assessment: Trainees will:* Participate in retrieval activities (tutor observation and questioning)
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| Information Technology should be selected on the basis of the task which is to be performed and different tools (hardware/ software) are suitable for different tasks. Information Technology use (including Internet searching) should be appropriate and efficient. |
| Cross-curriculum teaching with technology (TEL) does not meet the National Curriculum for Computing, unless there are specific learning objectives for Computing curriculum included; teachers should exploit cross-curriculum opportunities by planning learning for both subjects. |
| Online safety education should be tailored to meet the requirements of children at different stages of their development and technology use inside and outside of school. |
| **Phase 3** | **Trainees will know:**  | **Trainees will be able to:** |
| The difference between data and information | Use a range of applications for data handling |
| Branching databases can be used to store, organise and search data | Reflect on their own use of technology for data handling and how others may use their data |
| Companies and organisations analyse big data for patterns in consumer behaviour using algorithms  | Reflect on their subject knowledge and plan for further development.(**LH8.1, LH8.3, LH8.7)** |
| Functions, formulae and formatting in spreadsheets, including graphing capabilities |  |
| Use and design of flat file databases to store, organise, retrieve, report data |  |
| **Trainees will understand:**  | **Composite knowledge/understanding/skills***By the end of this phase trainees will* ***know:**** A database organises data logically allowing a computer or human to quickly store, sort, filter, search and report the data.

*By the end of this phase trainees will* ***understand:*** * That cross-curricular opportunities can be used to plan effectively for Computing;
* The programme of study is the minimum expectation for teaching and learning and they can plan beyond this.

*By the end of this phase trainees will be* ***able to:*** * Identify age-appropriate technologies for data handling and appropriate contexts for teaching data handling across KS1 and KS2.

Formative assessment: Trainees will:* Participate in retrieval activities (tutor observation and questioning)
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| Data handling is an everyday task which can be automated and made more efficient through the use of appropriate technology.  |
| Children can store, organise, sort, filter, search and report data using different age-appropriate technologies which are progressive. |
| Creative approaches for curriculum design and for teaching and learning in computing (**LT3.1, LT4.1, LT7.7**) |

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| Research, literature and resources supporting the curriculum design. | National Centre for Computing EducationBarefoot ComputingCode-ITHello World – Raspberry Pi FoundationRoyal Society: After the Reboot – Computing Education in UK SchoolsSentance, S., Waite, J. & Kallia, M., 2019. Teaching computer programming with PRIMM: a sociocultural perspective. *Computer Science Education*, 29(2-3), 136-176.Waite, J. 2017 Pedagogy in teaching Computer Science in schools: A Literature Review. Royal SocietyGrover, S, 2020. Computer science in K-12: An A-Z handbook on teaching programming. Edfinity: USASentance, S., Barendsen, E. & Schulte, C., 2018. Computer science education: perspectives on teaching and learning in school. Bloomsbury: LondonSimmons, C. & Hawkins, C., 2015. Teaching Computing. Sage: London |