**Programme of Study Key stage 2 from Naace and CAS**

**Design, write, and debug programs.** This should take place in a range of contexts from the use of programmable toys and devices to creating textual programs that can be run and tested. Programming should also include the use of software that provides a visual or graphical environment to support the design, writing and debugging of programs and to simulate physical and real world systems. Debugging is simply find out why a programme may not be working properly and correcting it; for example a floor robot may be intended to move in a square, but may move in a triangle if the angle is incorrect

 **Controlling or simulating physical systems.** These systems might include programmable toys and devices which are able to sense and respond to their environment using inputs such as switches and sensors and outputs such as lights, buzzers and motors. Pupils should form an awareness of common devices that use control/monitoring, such as the sensors that are part of a burglar alarm or the temperature control system in a freezer or central heating system

 **Sequence, selection and repetition** describe the basic structures of computer programs. These principles can be illustrated through flow diagrams or using software that visually or graphically represents programs.

 **Sequence**: programs consist of logically sequenced instructions or actions that are executed in order one after another. Pupils should create sequences of instructions to control events, and understand the need to be precise when framing and sequencing instructions.

 **Selection:** in a selection structure, a question is asked, and depending on the answer, the program chooses between two or more possible courses of action. At KS2, selection should include "if..then..else" type actions or statements. (E.g. in a game program, if the sprite is touching a wall then bounce back, else move forward). (Sprite - A 2D graphic image that can move within a larger graphic)

 **Repetition:** means repeating a sequence of instructions a certain number of times, or until some condition is met or result is achieved. In programming terms this means loops of all kinds, such as repeat, for, while, until etc. (e.g. move dog 1 step forward; repeat until dog is in kennel then stop).

 **Work with variables:** numbers and text can be stored and referred to in programs by using variables (e.g. name = "John"; print name; move dog (*variable is the number*) steps forward). The value a variable takes might come from user input by typing or selecting a value, or by setting a program so that a random variable is selected, or might be set and used by programmed instructions (e.g. for counter = 1 to 10; print counter; next counter). Pupils should explore the effects of changing the variables in computing based models, programs or simulations.

 **Various forms of input and output:** Methods of input may include keyboard, mouse, touch, microphone, camera, motion sensors, environment sensors and output may include screen, printers, speakers, switches and simulated or physical control devices. An output could be the action that a sprite performs as a result of being programmed or it could be a light coming on in response to movement in a room. Pupils should understand how computing devices with sensors can be used to monitor and measure external events.

 **Use logical reasoning to explain how some simple algorithms work** is a progression from "predict the behaviour of simple programs". Here we might hope for some explanation about why the algorithm will work regardless of the input or starting situation.

 **Understand computer networks** means, at this stage, knowing that a network consists of one or more computing devices connected together, using shared protocols, so they can share data and resources. Networks will include those that pupils may be familiar with, such as school or home networks. Protocols are the signals, messages and "passwords" that different computers use when "talking" to each other. A classroom is analogous to a network with lots of 'communicating devices' i.e. the pupils and teacher. Protocols in this case might include the various routes used to pass messages form one person to another, and/or using a protocol such as hand up to speak to the teacher.

 **The internet and provision of multiple services:** The internet is an example of a global computer network. The **world wide web** of hyperlinked webpages and websites is just one of the services that the internet provides. Examples of other services include email, voice calls, video conferencing and streaming media such as television and films.

 **Opportunities for communication and collaboration** is one of the most powerful impacts of the internet on pupils’ lives. Students should personally experience opportunities to exchange information and ideas both internally within the school and, where possible, externally. That experience should in turn inform, and be informed by, reflective discussion about issues such as respectful communication in a context where body language is absent; cultural differences; privacy; ownership of shared information, music, images, text; and safety.

 **Search technologies** include, but are not limited to, internet search engines. Pupils should be familiar with a number of search technologies, including those for searching for files and emails, and develop an appreciation of how to select the most effective search terms and criteria to get the best search results.

 **Appreciate how results are selected and ranked:** Pupils should understand that different search engines have algorithms that work in different ways (e.g. some ignore high frequency words and some consider word order). They should learn to critically evaluate search results and be aware that results and ranking are influenced by factors such as popularity, number of links to a page, availability, commercial interests, advertising and filtering.

 **Be discerning in evaluating digital content:** It is important that pupils have opportunities to validate information that they have found when using search engines. This could include exploring the reliability of content by checking against other sources or considering whether an author may have a biased viewpoint. The critical skills that pupils have started to develop when considering online digital content should also be applied to other sources of digital content.

 **Know a range of ways to report concerns and inappropriate behaviour:** This builds on pupils' prior learning, where the major emphasis will have been on reporting to an appropriate adult and the steps they may then follow on behalf of a pupil. Reporting concerns and inappropriate behaviour usually has a clear pathway for incidents in school and it is important that pupils are able to handle such concerns and behaviour when using digital content and tools when they are not in school, too. Pupils will need to know how to report concerns online and understand that different organisations are able to support people who have concerns; they will also understand that different organisations may be specialists in different areas, such as bullying. This learning will continue to be consolidated across the contexts provided by the whole Computing curriculum.

 **Variety of software on a range of devices:** This should include developing appropriate and effective use of online and offline productivity tools, creative tools, collaboration tools and software that enhances learning. In order to**select and use**, pupils need to have developed skills and understanding of the tools and devices from which they can choose. Creative tools will enable pupils to have experience of developing a full range of images, graphics, videos, digitally prepared text, sound, multimedia, animations, databases, websites, presentations, e-books and programs. Such creative tools allow pupils to develop and edit the digital artefacts they create in order to refine and improve them to achieve high quality solutions. For example, "selecting and using" might involve making an appropriate decision about the best text creation tool for the task, or pupils might need to decide whether it is better to present their ideas through an interactive presentation or an animation.

 **Analysing and evaluating information** to interpret information, check it is current, relevant and reasonable and to think about what might happen if there were any errors or omissions. Pupils should consider the source, quality, validity and any possible bias they might introduce to information. Pupils use spreadsheets, databases, models and simulations to analyse and evaluate patterns and relationships in data. (The acronym GIGO - garbage in, garbage out - related to the £million electricity bill can emphasise the point of evaluation in amusing fashion)

 **Collecting information** may be from both online and offline sources. Pupils select the information they need for different purposes, check its accuracy and organise it in a form suitable for processing. Information can be checked to find if it is replicated in other places and if it is consistent with other sources.

**Presenting information and data** should be done with consideration to accuracy and quality. A range of different digital artefacts can be used such as images, graphics, videos, digitally prepared text, sound, multimedia, animations, databases, websites, presentations, e-books and programs. When presenting information pupils should show awareness of, differentiate for and respect, intended audiences including teachers, peers, parents, friends, families and the public. Opportunities should be provided to exchange and present information interactively and through joint projects mediated via the Internet.

 **Use technology safely, respectfully and responsibly:** This builds on experiences in Key Stage 1, with increasing thoughtfulness about responsible use. This may include ethical and legal considerations. For example, when using digital content from online sources, it is important that pupils consider ownership issues, copyright and attribution. They might be encouraged to seek out different Creative Commons licensed images for use in their own work rather than a picture from a commercial copyright source. Using technology safely should include the choices and decisions that are made when using digital content and tools, such as opening pop-ups, links within communication from unknown sources, the explicit information that pupils share about themselves and the clues they provide which allow inferences to be drawn about e.g. their school, location. Introducing pupils to the behaviour that might be appropriate in an online community might be through a school learning platform or other collaborative/communication tools and it will also refer to the types of social media that they are familiar with, which might include "child-oriented" social media or gaming, such as Club Penguin. This learning will continue to be consolidated across the contexts provided by the whole Computing curriculum.