Charles Darwin Community Primary School Progression in Design Technology
Year 6

Term **Topic**	**Autumn** **Dragons Den**	**Summer** **Design, make and evaluate a shopping bag for a grandparent to take to the shops**	**Spring** **Design, make and evaluate a CAD structure for making a vehicle for a toy.**
Themes	Electrical - More Complex Switches	Textiles - Using CAD in textiles	Frame Structures - Computer Aided Frame structures
Prior knowledge	From Year 5 making a toy money box	Textiles – making purses Y4 CAD in Term 2	Y2 making vehicles
Prior skills	Understanding of the essential characteristics of a series circuit and experience of creating a battery-powered, functional, electrical product. • Initial experience of using computer control software and an interface box or a standalone box, e.g. writing and modifying	Experience of stitching, joining and finishing techniques in textiles. • Experience of making and using textiles pattern pieces. • Experience of simple computer-aided design applications	Experience of using different joining, cutting and finishing techniques with materials. • A basic understanding of 2-D and 3-D shapes in mathematics and the physical properties and everyday uses of materials in science. • Familiarity with general purpose software that can be used to draw accurate shapes, such as 2D Primary by Techsoft, or 3D CAD such as Tinkercad
Key vocabulary	series circuit, parallel circuit, names of switches and components, input device, output device, system, monitor, control, program, flowchart • function, innovative, design specification, design brief, user, purpose	computer aided design (CAD), computer aided manufacture (CAM) • font, lettering, text, graphics, menu, scale, modify, repeat, copy, flip • design brief, design criteria, design decisions, innovative, prototype • seam, seam allowance, wadding, reinforce, right side, wrong side, hem, template, pattern pieces • names of textiles and fastenings used, pins, needles, thread, pinking shears, fastenings, iron transfer paper • annotate, functionality, innovation, authentic, user, purpose, evaluate, mock-up, prototype	• frame structure, three-dimensional (3D) shape, triangulation, compression, tension, bending, torsion, load, capacity • marking out, measuring, shaping, joining, assembly, accuracy, material, strong, reduce, reuse, recycle, reinforce • function, performance, decision, evaluating, design brief, design criteria, innovation, prototype • CAD related terms e.g. handle, workplane etc
NC Statutory Requirements	**Key stage 2** Through a variety of creative and practical activities, pupils should be taught the knowledge, understanding and skills needed to engage in an iterative process of designing and making. They should work in a range of relevant contexts [for example, the home, school, leisure, culture, enterprise, industry and the wider environment]. When designing and making, pupils should be taught to: **Design** use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design **Make** select from and use a wider range of tools and equipment to perform practical tasks [for example, cutting, shaping, joining and finishing], accurately select from and use a wider range of materials and components, including construction materials, textiles and ingredients, according to their functional properties and aesthetic qualities **Evaluate** investigate and analyse a range of existing products evaluate their ideas and products against their own design criteria and consider the views of others to improve their work understand how key events and individuals in design and technology have helped shape the world **Technical knowledge** apply their understanding of how to strengthen, stiffen and reinforce more complex structures understand and use mechanical systems in their products [for example, gears, pulleys, cams, levers and linkages] understand and use electrical systems in their products [for example, series circuits incorporating switches, bulbs, buzzers and motors] apply their understanding of computing to program, monitor and control their products.		

<table>
<tr>
<td>Technical knowledge and understanding</td>
<td>

Micro-switch – a switch that can operate as push-to-break switch or a push-to-make switch.
Push-to-break switch – a switch turned off by pressing it.
Push-to-make switch – a switch turned on by pressing it.
Reed switch – a switch operated by a magnet.
Tilt switch – a switch that works when tilted at an angle.
Toggle switch – a switch operated when a lever is pressed.
Light dependent resistor (LDR) – a sensor that operates when light is shined on it.

Children need to learn how to write a sequence of instructions where a decision is made e.g. when a switch is pressed a buzzer is activated.
They use a ‘control language’ or create a flowchart to produce a series of instructions.
Children’s computing knowledge and skills need to focus on using input and output devices connected to a standalone box or interface box.
They use their learning in computing to control and monitor productsthey have designed and made e.g. alarm system.

</td>
<td>
Using Wild Things
This free software allows you to create patterns for a wide range of products. There are simple as well as more complex designs that you can adapt to your children’s needs. The designs are grouped as Hats, Wraps, Bags, Belts and Footwear and it has a range of styles for pockets to add to each item. You can set the units of measurement, sleeve length and openings and back length. It also contains an illustrated sewing dictionary that helps with understanding textiles terms in the context of their use
</td>
<td>
When to use CAD

When children understand the value of using it to improve the accuracy and appearance of their products
Where it achieves learning objectives more efficiently
Where children have been taught and practised the necessary computing skills
Wherever possible, to design the functional and aesthetic features of a product

When not to use CAD

When children do not have sufficient understanding of the product they are designing
As a substitute for practical activities with actual materials and components
When a project can be delivered as effectively without it
When taking a CAD approach would be take longer or be less effective than making physical outcomes

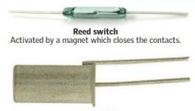
</td>
</tr>
<tr>
<td>Techniques</td>
<td>
Switches and sensors

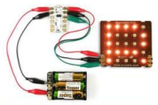
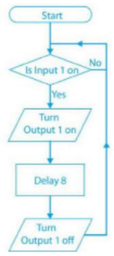
Latching switch

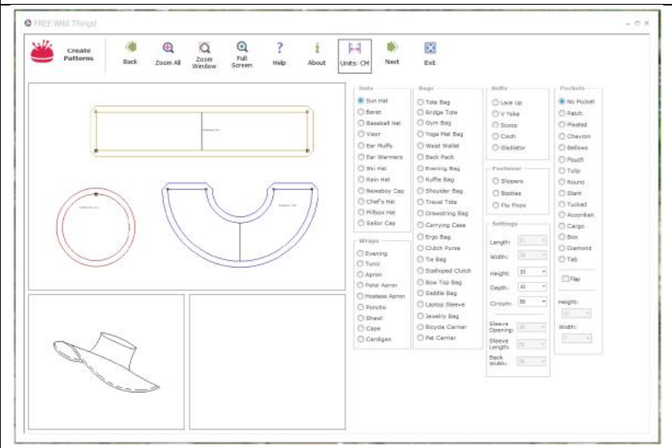
Micro-switch

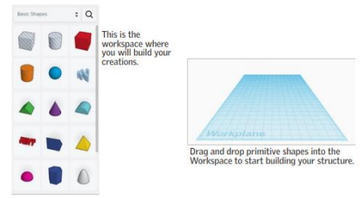
Light-dependent resistor (LDR)

Push-to-make switch
When you push, the electricity flows through the circuit, but when you release it the circuit is broken and the switch is off.

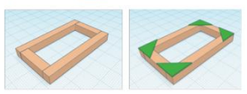
Push-to-break switch
The switch is off while the button is pushed, but returns to its ‘on’ position when button is released.

Reed switch
Activated by a magnet which closes the contacts.

Tilt switch
When tilted a ball bearing bridges the contacts inside, completing the circuit.

Crumble


</td>
<td>


</td>
<td>
Using Tinkercad
Tinkercad has a range of simple tools that allow you to create basic shapes, but it can also combine them to create more complex objects


Drag and drop primitive shapes into the Workspace to start building your structure.
Explore and use the different workspaces that can convert your creations into LEGO or Minecraft. Use simulation to test out your structures.

Join elements together to build up frame structures.

</td>
</tr>
<tr>
<td>KPIs</td>
<td>
Designing
• Use research to develop a design specification for a functional product that responds automatically to changes in the environment. Take account of constraints including time, resources and cost.
• Generate and develop innovative ideas and share and clarify these through discussion.
• Communicate ideas through annotated sketches, pictorial representations of electrical circuits or circuit diagrams.
</td>
<td>
Designing
• Generate innovative ideas through research including surveys, interviews and questionnaires.
• Develop, model and communicate ideas through talking, drawing, templates, mock-ups and prototypes including using computer-aided design.
• Design purposeful, functional, appealing products for the intended user that are fit for purpose based on a simple design specification.
</td>
<td>
Designing
• Generate realistic ideas and design criteria collaboratively through discussion, focusing on the needs of the user and the functional and aesthetic purposes of the product.
• Develop ideas through the analysis of existing frame structures and use computer-aided design to model and communicate ideas.
</td>
</tr>
<tr>
<td></td>
<td>
Making
• Formulate a step-by-step plan to guide making, listing tools, equipment materials and components.
• Competently select and accurately assemble materials, and securely connect electrical components to produce a reliable, functional product.
• Create and modify a computer control program to enable an electrical product to work automatically in response to changes in the environment.
</td>
<td>
Making
• Produce detailed lists of equipment and fabrics relevant to their tasks.
• Formulate step-by-step plans and, if appropriate, allocate tasks within a team.
• Select from and use a range of tools and equipment, including CAD, to make products that are accurately assembled and well finished. Work within the constraints of time, resources and cost.
</td>
<td>
Making
• Plan the order of the main stages of making.
• Select and use appropriate tools and software to measure, mark out, cut, score, shape and assemble with some accuracy.
• Explain their choice of materials according to functional properties and aesthetic
qualities.
</td>
</tr>
</table>

			• Use computer-generated models suitable for the product they are creating.
	Evaluating • Continually evaluate and modify the working features of the product to match the initial design specification. • Test the system to demonstrate its effectiveness for the intended user and purpose. • Investigate famous inventors who developed ground-breaking electrical systems and components.	**Evaluating** • Investigate and analyse textile products linked to their final product. • Compare the final product to the original design specification. • Test products with intended user, where safe and practical, and critically evaluate the quality of the design, manufacture, functionality and fitness for purpose. • Consider the views of others to improve their work.	**Evaluating** • Investigate and evaluate a range of frame structures including the materials, components and techniques that have been used. • Test and evaluate their own products against design criteria and the intended user and purpose.
	Technical knowledge and understanding • Understand and use electrical systems in their products. • Apply their understanding of computing to program, monitor and control their products. • Know and use technical vocabulary relevant to the project	**Technical knowledge and understanding** • A 3D textile product can be made from a combination of accurately made pattern pieces, fabric shapes and different fabrics. • Fabrics can be strengthened, stiffened and reinforced where appropriate.	**Technical knowledge and understanding** • Develop and use knowledge of box and frame structures and, where appropriate, more complex 3D structures. • Develop and use knowledge of how to construct strong, stiff frame structures. • Know and use technical vocabulary relevant to the project.
Links to other subjects	**Mathematics** – apply understanding and skill to carry out accurate measuring using standard units i.e. cm/mm. **Science** – apply knowledge and understanding of circuits, switches, conductors and insulators. **Computing** – design, write and debug programs that accomplish specific goals, including controlling physical systems. Use sequence, selection, and repetition in programs. Work with variables and various forms of input and output.	**Computing** – select, use and combine a variety of software to design and create a range of patterns and other content that accomplish given goals, including presenting data and information. **Mathematics** – apply knowledge of how 2-D patterns can be joined to make 3-D products; apply skills of accurate measuring using standard units i.e. cm/mm. **Art and design** – investigate methods of adding colour, pattern and texture on to textiles through appliqué, iron transfer paper and/or dye sublimation	**Science** – discuss the properties and suitability of materials for particular purposes. Look at forces acting on structures. **Mathematics** – compare and sort common 2D and 3D structure in everyday objects. Recognise forces in structures and describe them. Develop spatial awareness. **Spoken language** – ask relevant questions to extend knowledge and understanding. Build their technical vocabulary
Lessons	**Investigative and Evaluative Activities (IEAs)** Using research, discuss a range of relevant products that respond to changes in the environment using a computer control program such as automatic nightlights, alarm systems, security lighting • Investigate electrical sensors such as light dependent resistors (LDRs) and a range of switches such as push-to-make switches, push-to-break switches, toggle switches, micro switches and reed switches. To gain an understanding of how they are operated by the user and how they work, ask the children to use each component to control a bulb in a simple circuit. Remind children about the dangers of mains electricity. • Children could research famous inventors related to the project e.g. Thomas Edison – light bulb.	**Investigative and Evaluative Activities (IEAs)** Children investigate and evaluate a range of existing textiles products and how they have been constructed using disassembly, and evaluate what the fabric shapes look like, how the parts have been joined, how the product has been strengthened and stiffened, what fastenings have been used and why. • Investigate work by designers and their impact on fabrics and products. Use questions to develop understanding • Children investigate properties of textiles through investigation e.g. exploring insulating properties, water resistance, wear and strength of textiles	**Investigative and Evaluative Activities (IEAs)** • Children investigate a collection of different frame structures including products, furniture and apparatus. Use questions to develop children's understanding • Children analyse a small structure identifying and discussing including the supports • Evaluate existing products to determine which designs children think are the most effective. Provide opportunities for the children to judge the suitability of the frame structures for their intended users and purposes. Discuss how effective the structure is and how it could be improved
	Focused Tasks (FTs) Through teacher demonstration and explanation, recap measuring, marking out, cutting and joining skills with construction materials that children will need to create their electrical products. • Demonstrate and enable children to practise methods for making secure electrical connections e.g. using automatic wire strippers, twist and tape electrical connections, screw connections and connecting blocks. • Drawing on science understanding, ask the children to explore a range of electrical systems that could be used to control their products, including a simple series circuit where a single output device is controlled, a series circuit where two output devices are controlled by one switch and, where appropriate, parallel circuits where two output devices are controlled independently by two separate switches. • Drawing on related computing activities, ensure that children can write computer control programs that include inputs, outputs and decision making. Test out the programs using electrical components connected to Crumble or Micro:bit. • Teach children how to avoid making short circuits.	**Focused Tasks (FTs)** Develop computer-aided design (CAD) skills by using pattern making software to generate, modify, scale, save and print pattern pieces. Recognise that designs can be easily modified and repeated on the computer without the need for a physical product. Investigate using art packages on the computer to design prints that can be applied to textiles using iron transfer paper. • Develop skills of 2D paper pattern making using CAD and create a 3-D paper or Dipryl mock-up of a chosen product. Remind/teach how to pin a pattern on to fabric ensuring limited wastage, how to leave a seam allowance and use different cutting techniques. • Develop skills of threading needles and joining textiles using a range of stitches, building upon children's earlier experiences of stitches e.g. improving appearance and consistency of stitches and introducing new stitches. If available, demonstrate and allow children to use sewing machines to join fabric with close adult supervision. • Develop skills of sewing textiles by joining right side together and making seams. Children should investigate how to sew and shape curved edges by snipping seams,	**Focused Tasks (FTs)** • Demonstrate simple 3D CAD software such as Tinkercad. Ask children to explore the interface and drawing tools to practise drawing and manipulating shapes such as cubes, spheres, cylinders, and triangles. • Ask children to use the inbuilt simulation tools to test their structures. • Let the children explore and be guided to try out different shapes and tools to become familiar with the 3D construction aspects of the available software to achieve the desired appearance of their products. • Practise making structures from sections of wood, dowel or art straws, joining supporting structures with glue to create 3-D shapes. Experiment with assembling pre-drawn structures in numerous ways using cutting and assembling techniques. Allow children to construct a simple box frame and show how it can be reinforced with card triangles in the corners and struts spanning across

		how to tack or attach wadding or stiffening and learn how to start and finish off a row of stitches.	
	Design, Make and Evaluate Assignment (DMEA) • Develop an authentic and meaningful design brief with the children. • Ask the children generate innovative ideas by drawing on research and develop a design specification for their product, carefully considering the purpose and needs of the intended user. • Communicate ideas through annotated sketches, pictorial representations of electrical circuits or circuit diagrams. Drawings should indicate the design decisions made, including the location of the electrical components and how they work as a system with an input, process and output. • Produce detailed step-by-step plans and lists of tools, equipment and materials needed. If appropriate, allocate tasks within a team. • Make high quality products, applying knowledge, understanding and skills from IEAs and FTs. Create and modify a computer control program to enable the product to work automatically in response to changes in the environment. • Critically evaluate throughout and the final product, comparing it to the original design specification. Test the system to demonstrate its effectiveness for the intended user and purpose.	**Design, Make and Evaluate Assignment (DMEA)** Set an authentic and meaningful design brief. Children generate ideas by carrying out research using surveys, interviews, questionnaires and the internet. Develop a design specification for their product. • Communicate ideas through detailed, annotated drawings from different perspectives. Drawings should indicate the design decisions made, methods of strengthening, the type of fabrics to be used and the types of stitching that will be incorporated. • Produce step-by-step plans, lists of tools equipment, fabrics and components needed. Allocate tasks within a team if appropriate. • Develop their design using CAD software to produce pattern pieces and art programmes to produce decoration and design prints that can be applied to textiles. • Make high quality products applying knowledge, understanding and skills from IEAs and FTs. Incorporate simple computer-aided manufacture (CAM) if appropriate e.g. printing on fabric. Use a range of techniques to ensure a well-finished final product that matches the intended user and purpose. • Evaluate both as the children proceed with their work and the final product in use, comparing the final product to the original design specification. Critically evaluate the quality of the design, the manufacture, functionality, innovation shown and fitness for intended user and purpose, considering others' opinions. Communicate the evaluation in various forms e.g. writing for a particular purpose, giving a well-structured oral evaluation, speaking clearly and fluently	**Design, Make and Evaluate Assignment (DMEA)** • Develop a design brief with the children within a context which is authentic and meaningful. • Discuss the uses and purposes of their frame structure • Ask the children to develop a design using computer-aided design (CAD) software to create structures, addressing the needs of the user and the purpose. Use simulation in Tinkercad to test the structures. • Using computer-aided design (CAD) software ask the children to prepare their designs for 3D printing in order to evaluate and refine their ideas • Ask children to identify the main stages of making and the appropriate tools and skills they learnt through focused tasks. Encourage the children to work with accuracy, using their computer-aided design (CAD) skills as appropriate. • Evaluate throughout and the final products against the intended purpose and with the intended user, where safe and practical, drawing on the design criteria previously agreed.
Assessment	How did you use research to help with your design? How did you make sure throughout the project that you stuc to the brief? How did you use prior learning to help you? How did you choose which person did which job? How did you make the product both practical and appealing? How did you then pitch your product? Which was the hardest part? How did you overcome any difficulties? How many times did you test it? What would you change if you made it again? .	How did you communicate your ideas? (through talking, drawing, templates, mock-ups and prototypes including using computer-aided design) What made your product fit for purpose? How did you decide on the finished design? How did you ensure your product was well made? Was the product fit for purpose? How did you test it? What improvements/alterations did you make? Does the intended user use it?	Which prior leaning supported you in this project? Why was planning important? Did you learn any new techniques? Which part of the design was the most important to get right? Did your finished product match the design? How was it similar? How did it differ? If you made the product again what would you change? • Develop and use knowledge of box and frame structures and, where appropriate, more complex 3D structures. • Develop and use knowledge of how to construct strong, stiff frame structures. • Know and use technical vocabulary relevant to the project.