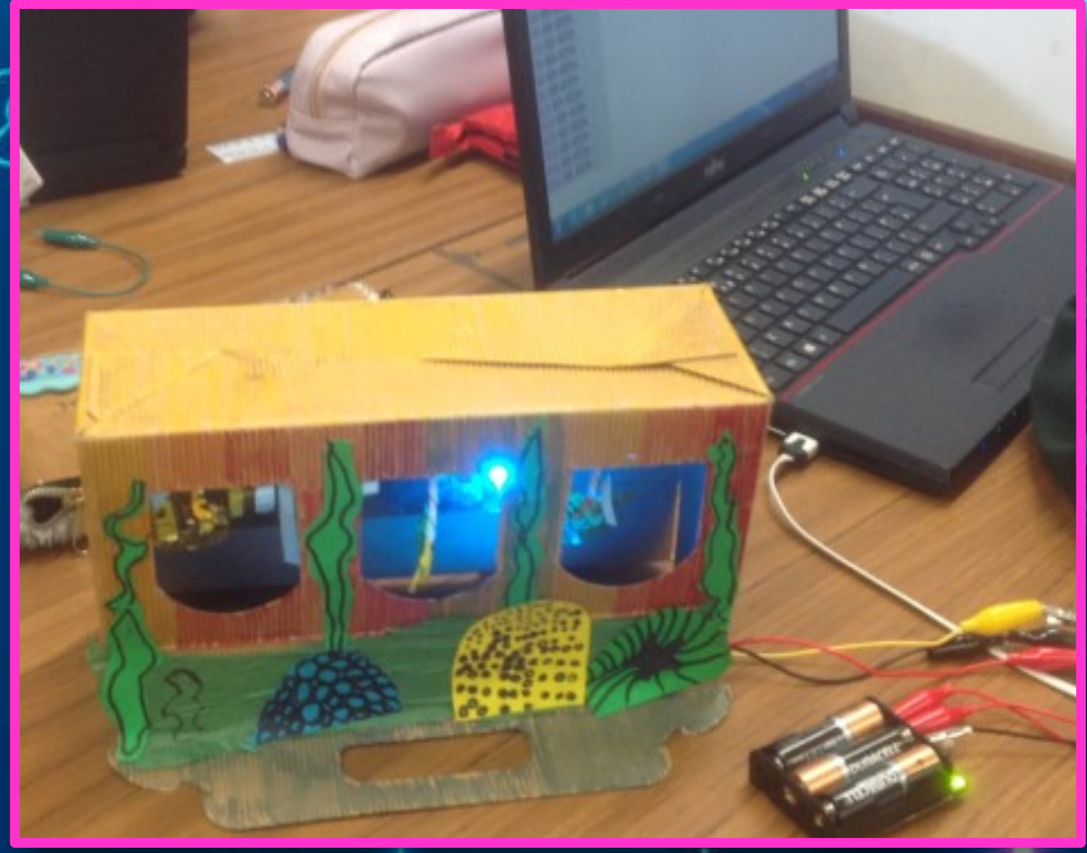
BILTON COMMUNITY FEDERATION

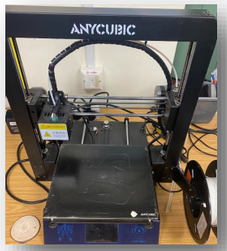
Design Technology Progression Document



Design Technology

Curriculum Intent

It is our intent that children will leave our schools resilient, emotionally literate, aspirational, effective communicators who are happy and therefore ready for the next stage of their life through the behaviour, knowledge and skills they have learnt whilst in our care. If we can achieve this for our children then we believe we are giving them the best opportunity to achieve success in their life. Through an inclusive and stimulating environment we will develop every child and allow them to write their own story in life. This intent is defined as our REACH principles.



Resilient: Every child is resilient.
Emotionally Literate: Every child is aware of their feelings and those of others.
Aspirational: Every child aspires for more in their learning and in life.
Communicators: Every child is an effective communicator.
Happy: Every child has the right to be happy. Bilton Community Federation
Our vision is to empower children to make a positive impact on the world and to apply the following values in all they do: **Care, Co-operation, Honesty, Forgiveness, Respect and Resilience.**

Design and Technology encourages children to learn to think and intervene creatively to solve problems both as individuals and as members of a team. At Bilton C of E Junior School, we encourage children to use their creativity and imagination, to design and make products that solve real and relevant problems within a variety of contexts, considering their own and others' needs, wants and values. We aim, where possible, to link work to other subjects such as mathematics, science, computing and art. The children are also given opportunities to reflect upon and evaluate past and present design technology, its uses and its effectiveness.

Through a variety of creative and practical activities, we teach the knowledge, understanding and skills needed to engage in the process of designing and making. The children design and create products that meet a function and purpose and which are relevant to a range of sectors (for example, the home, school and the wider environment).

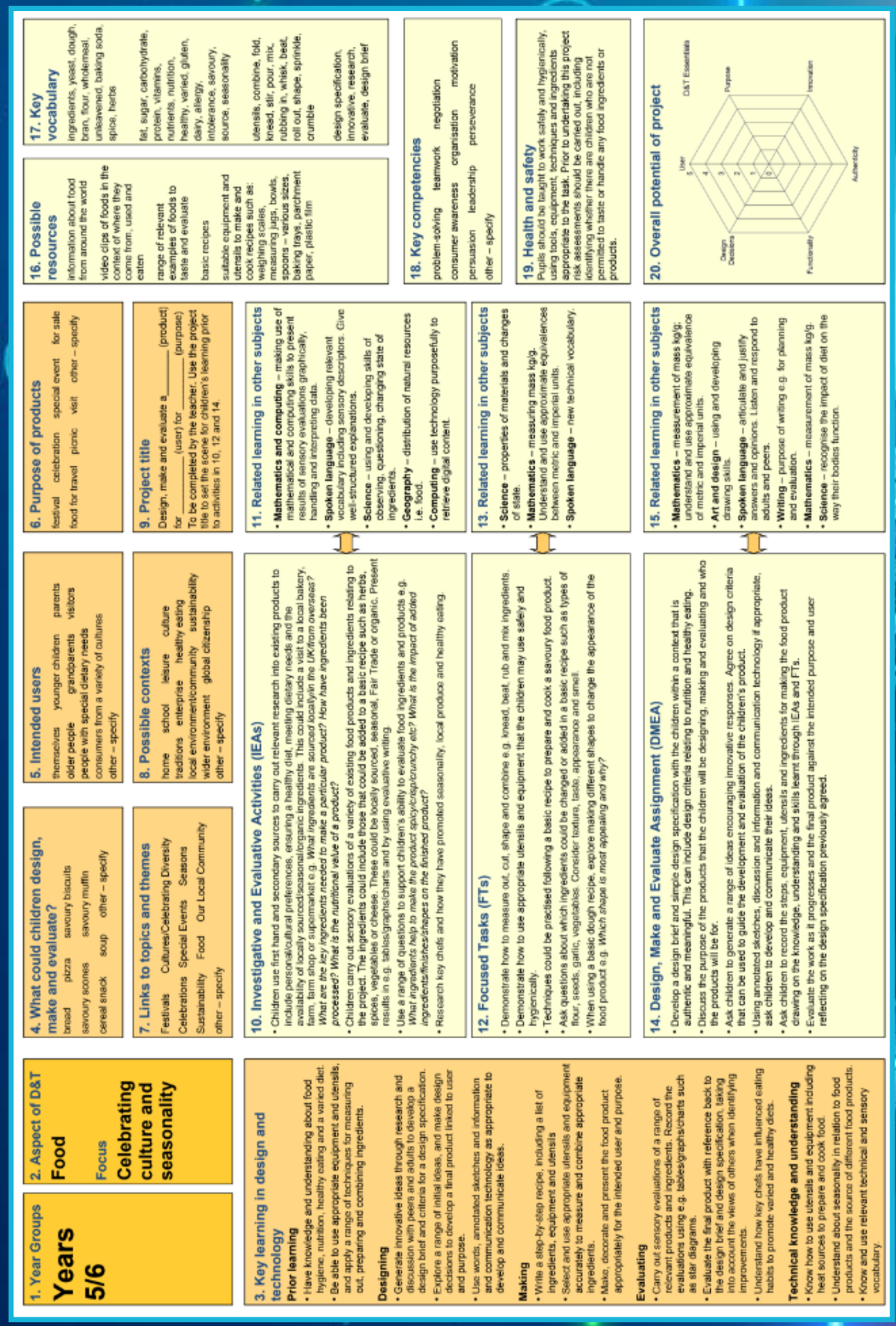
When designing and making, the children are taught to:

Design:
• to use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose and aimed at particular individuals or groups.
• generate, develop, model and communicate their ideas through discussion, annotated sketches, diagrams, prototypes, and computer-aided design.

Make:
• select from and use a range of tools and equipment to perform practical tasks (for example, cutting, shaping, joining and finishing, as well as chopping and slicing) accurately.
• select from and use a range of materials, ingredients and components, including construction materials, textiles and ingredients, according to their functional properties, aesthetic qualities and, where appropriate, taste.

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.
• understand and use electrical systems in their products.
• apply their understanding of computing to program, monitor and control their products
• Understand some of the ways that food can be processed and the effect of different cooking practices (including baking and grilling).



1. Year Groups

Years 5/6

2. Aspect of D&T

Electrical systems

Focus

More complex switches and circuits

3. Key learning in design and technology

Prior learning

- 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 a program to make a light flash on and off.

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.

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.

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.

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.

4. What could children design, make and evaluate?

vehicle alarm security lighting system
alarm for valuable artefact
automatic nightlight electrical board game
alarm for school shed other – specify

5. Intended users

vehicle owner themselves
school community school administrator
younger children siblings parents
museum curator other – specify

6. Purpose of products

safety protection security detection
warning comfort illumination entertainment
other – specify

7. Links to topics/themes

Our School Toys and Games
Keep Safe Ourselves
Culture and Leisure Travel Homes
Buildings other – specify

8. Possible contexts

home school community culture
leisure enterprise business
other – specify

9. Project title

Design, make and evaluate a _____ (product) for _____ (user) for _____ (purpose).
To be completed by the teacher. Use the project title to set the scene for children's learning prior to activities in 10, 12 and 14.

10. 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 e.g. *Who have the products been designed for and for what purpose? How and why is a computer control program used to operate the products? What input devices, e.g. switches, and output devices, e.g. bulbs, have been used?*
- 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.

11. Related learning in other subjects

- **Spoken Language** – ask relevant questions, give well-structured descriptions and explanations. Build technical vocabulary.
- **Computing** – use technologies for research purposes and be discerning when evaluating digital content.
- **Science** – apply knowledge and understanding of circuits, switches, conductors and insulators.

12. 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 interface boxes or standalone boxes.
- Teach children how to avoid making short circuits.

13. Related learning in 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.

14. 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.

15. Related learning in 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.

16. Possible resources

zinc carbon or zinc chloride batteries, crocodile leads, bulbs, bulb holders, buzzers, light emitting diodes (LEDs), micro switches, reed switches and magnets, light dependent resistors (LDRs), wire, automatic wire strippers, masking tape, construction materials and tools as required

computer control software and interface boxes or standalone boxes, connecting leads

17. 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

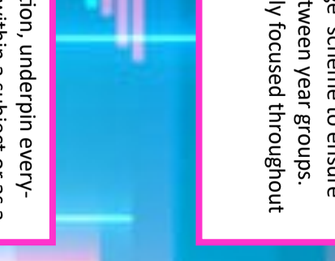
18. Key competencies

problem-solving teamwork negotiation
consumer awareness organisation motivation
persuasion leadership perseverance
other – specify

19. Health and safety

Pupils should be taught to work safely, using tools, equipment, materials, components and techniques appropriate to the task. Risk assessments should be carried out prior to undertaking this project.

20. Overall potential of project



We are members of the Design and Technology Association and use their 'Projects on a Page' scheme to ensure key skills and knowledge for have been mapped across the school to ensure progression between year groups. Design and technology lessons are also taught as a block so that children's learning is sharply focused throughout each unit of work.

Our Christian Values

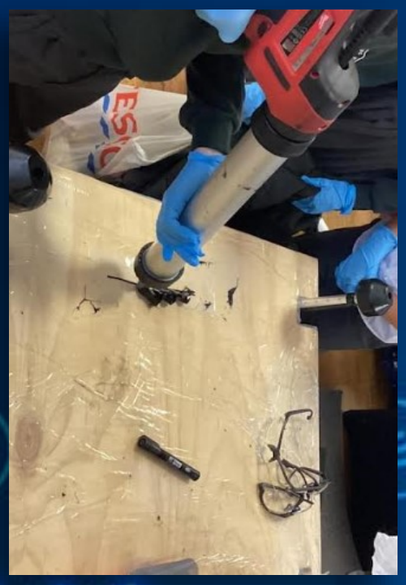
Our core Christian Values of: Respect, Care, Honesty, Forgiveness, Resilience and Co-operation, underpin everything we do at BJS and are woven across all subjects. These values may be taught explicitly within a subject or as a thread throughout everyday school life.

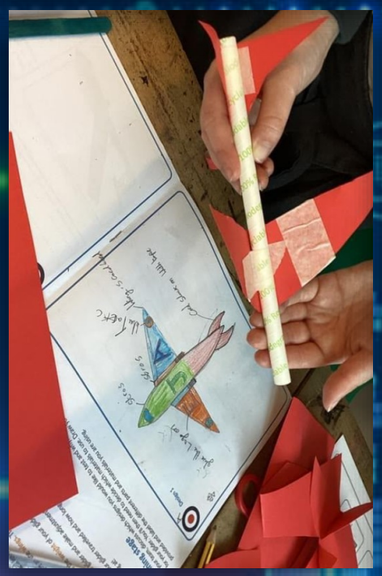
In Design Technology children co-operate in making decisions and sharing resources. They develop resilience through working together to solve problems with initial designs, using prototypes to help then develop their thinking. They show care and respect with their commitment to environmental awareness when using materials in the designs and creations.

What makes our curriculum unique?

As a school, we work with the Small Piece Trust to deliver a STEM day based around designing and making products such as gliders. Children also take part in 'Meet the STEM Superstars' where they have the opportunity to find out about STEM based career opportunities with the RAF.

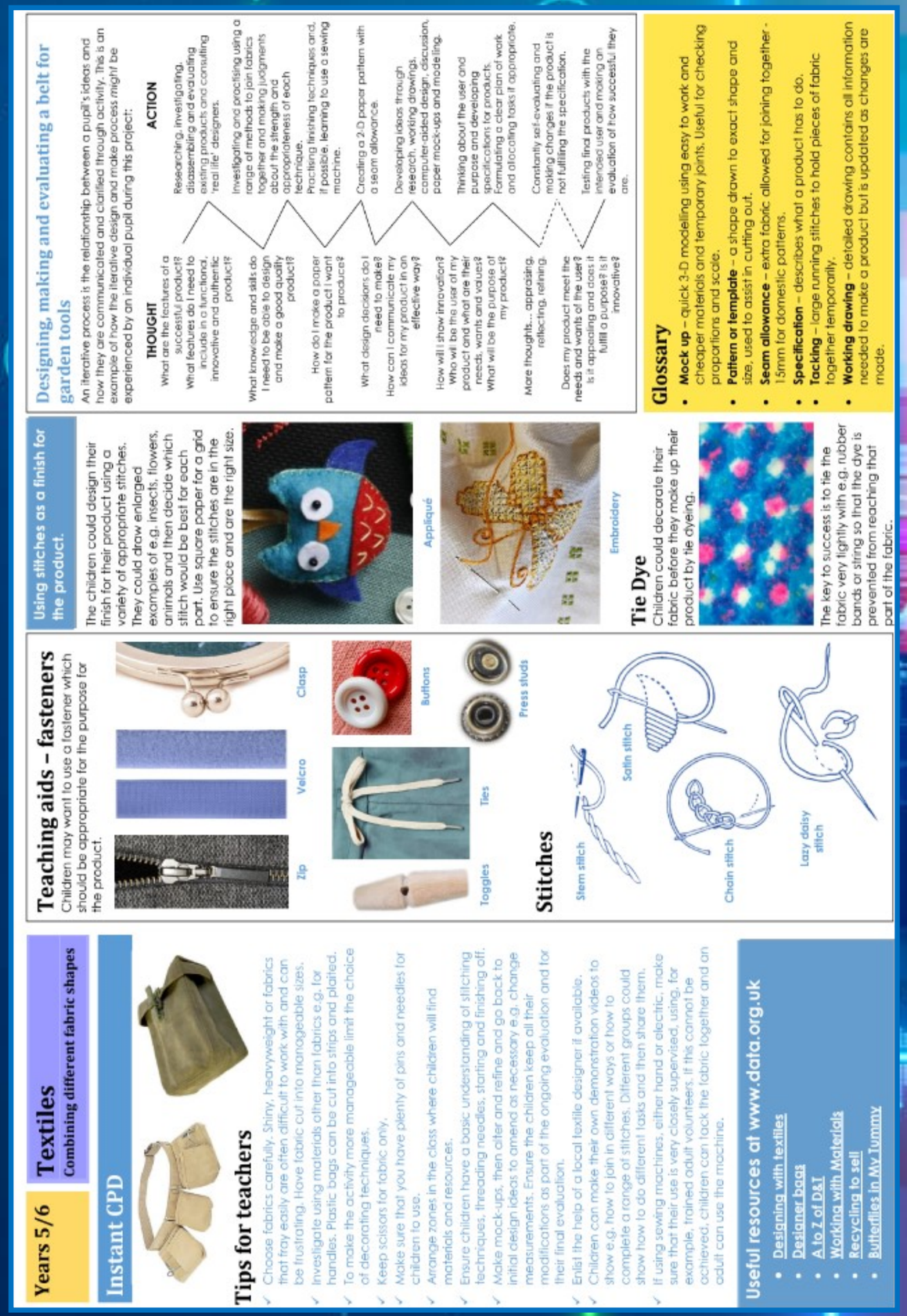
We have a popular craft club where children can learn a range of skills related to textiles, food and woodwork. Imagineering also runs throughout the school year The aim of the club is to introduce children to the fascinating world of engineering and technology through fun, hand-on activities.





Curriculum Overview

	Autumn	Spring	Summer
Year 3	**Mechanical Systems** **Christmas Cards with moving parts** Children investigate books and cards using a range of lever mechanisms. They practise accurate use of measuring, marking out, cutting, joining and finishing skills and techniques. They create their own labelled designs and evaluate their work against the design brief.	**Healthy Snack** **Wraps and Sandwiches** Children investigate popular lunchbox options. They design their own sandwich or wrap using knowledge of a balanced diet. They make their sandwich using appropriate equipment and evaluate their work.	**Design and Create a 3-D Box** Children explore different shell structures investigating nets for different shapes. They design, construct and evaluate their own gift boxes.
Year 4	**Food—Mayan Day** Children taste and evaluate different salads, thinking about the seasonality of products. They learn to select and use a range of utensils and use a range of techniques as appropriate to prepare ingredients hygienically.	**Textiles** Roman Bulla Purse Children practise different stitches. They learn how to pin fabric and leave a seam allowance. Children design, make and evaluate a Roman purse design.	**Electrical Systems** **Night Lights** Linking with their Science work, children construct electrical circuits. They evaluate night lights before creating a design for their own product which is evaluated against the design brief.
Year 5	**Mechanisms—Cam Toys** Children explore different types of can mechanism. They create annotated sketches of their own designs and create prototypes to test and refine their ideas.	**Food Technology—Bread** Children taste and evaluate a variety of bread. They follow a recipe for baking bread and make adaptations for their own final bread product.	**Frame Structures—Bird Hides** Children investigate different frame structures. They analyse existing products. Children produce a detailed step by step plan for making their own bird hide model, listing the tools and materials needed for the task.
Year 6	**Poppy Badges—Textiles** Linking with their work in History, children explore different poppy badges and brooches. They learn to use a paper pattern, how to sew and shape curved edges and a variety of stitches for their own design.	**Alarm Systems** Children investigate sensors and switches. They develop a design specification for their product, carefully considering the purpose and needs of the intended user. They communicate their ideas through annotated sketches, and pictorial representations of electrical circuits or circuit diagrams.	**Baking** Children evaluate different scones. They follow a recipe before making their own adaptations, thinking about seasonality, flavour, texture and aroma



Year 6

1. Year Groups
Years 5/6

2. Aspect of D&T
Textiles

Focus

Combining different fabric shapes

4. What could children design, make and evaluate?
tablet case | mobile phone carrier | shopping bag | insulating bag | hat/cap | garden tool belt | slippers | sandals | fabric advent calendar | fabric door stop | other – specify

5. Intended users
themselves | younger children | older children | teenagers | parents | school | grandparents | teachers | gardeners | other – specify

6. Purpose of products
celebration | educational | interests | hobbies | environmental | lifestyle | religious | protection | other – specify

7. Links to topics and themes
Clothing | Hot and Cold | Communication | Festivals | Celebrations | Weather | Sustainability | Our School | Environment | other – specify

8. Possible contexts
home | school | leisure | culture | enterprise | environment | local community | other – specify

9. Project title
Design, make and evaluate a _____ (product) for _____ (user) for _____ (purpose).

To be completed by the teacher. Use the project title to set the scene for children's learning prior to activities in 10, 12 and 14.

16. Possible resources
existing textile products for investigation and deconstruction linked to their product

wide selection of textiles including reclaimed and reusable fabrics, dipryl

pins, needles, thread, measuring tape, left/right handed fabric scissors, pinking shears iron, iron transfer paper, sewing machine

range of fastenings, materials for insulating or strengthening e.g. bubble wrap, wadding, interfacing

finishing materials e.g. sequins, buttons, fabric paints

17. Key vocabulary
seam, seam allowance, wadding, reinforce, right side, wrong side, hem, template, pattern pieces

name of textiles and fastenings used, pins, needles, thread, pinking shears, fastenings, iron transfer paper

design criteria, annotate, design decisions, functionality, innovation, authentic, user, purpose, evaluate, mock-up, prototype

3. Key learning in design and technology

Prior learning
- Experience of basic stitching, joining textiles and finishing techniques.
- Experience of making and using simple pattern pieces.

Designing
- Generate innovative ideas by carrying out research including surveys, interviews and questionnaires.
- Develop, model and communicate ideas through talking, drawing, templates, mock-ups and prototypes and, where appropriate, computer-aided design.
- Design purposeful, functional, appealing products for the intended user that are fit for purpose based on a simple design specification.

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 to make products that are accurately assembled and well finished. Work within the constraints of time, resources and cost.

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 and critically evaluate the quality of the design, manufacture, functionality and fitness for purpose.
- Consider the views of others to improve their work.

Technical knowledge and understanding
- A 3-D 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.

10. Investigative and Evaluative Activities (IEAs)
- Children investigate, analyse and evaluate a range of existing products which have been produced by combining fabric shapes. Investigate work by designers and their impact on fabrics and products. Use questions to develop children's understanding e.g. *Is the product functional or decorative? Who would use this product? What is its purpose? What design decisions have been made? Do the textiles used match the intended purpose? What components have been used to enhance the appearance? To what extent is the design innovative?*
- Children investigate and analyse how existing products have been constructed. Children disassemble a product and evaluate what the fabric shapes look like, how the parts have been joined, how the product has been strengthen and stiffened, what fastenings have been used and why.
- Children investigate properties of textiles through investigation e.g. exploring insulating properties, water resistance, wear and strength of textiles.

11. Related learning in other subjects
- **Spoken language** – ask questions, formulate, articulate and justify answers, arguments and opinions. Consider and evaluate different viewpoints.
- **Science** – work scientifically investigating properties of fabrics. Children plan different types of scientific enquiries to answer questions.
- **History** – significant person/people in their locality linked to textiles and products e.g. William Morris, Amanda Wakeley.

12. Focused Tasks (FTs)
- Develop skills of threading needles and joining textiles using a range of stitches. This activity must build 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, how to tack or attach wadding or stiffening and learn how to start and finish off a row of stitches.
- Develop skills of 2-D paper pattern making using grid or tracing paper to create a 3-D 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 different cutting techniques.
- Develop skills of computer-aided design (CAD) by using on-line pattern making software to generate pattern pieces. Investigate using art packages on the computer to design prints that can be applied to textiles using iron transfer paper.

13. Related learning in other subjects
- **Mathematics** – apply knowledge of how 2-D nets can be formed into 3-D shapes; 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 and how to make their own textiles through weaving or felt making.
- **Computing** – children express themselves and develop ideas using a range of information and communication technology resources.

18. Key competencies
problem-solving | teamwork | negotiation | consumer awareness | organisation | motivation | persuasion | leadership | perseverance | other – specify

19. Health and safety
Pupils should be taught to work safely, using tools, equipment, materials, components and techniques appropriate to the task. Risk assessments should be carried out prior to undertaking this project.

14. Design, Make and Evaluate Assignment (DMEA)
- Set an authentic and meaningful design brief. Children generate ideas by carrying out research using e.g. surveys, interviews, questionnaires and the web. Children develop a simple design specification for their product.
- Communicate ideas through detailed, annotated drawings from different perspectives and/or computer-aided design. Drawings should indicate design decisions made, the 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.
- 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. Children use a range of decorating 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.

15. Related learning in other subjects
- **Art and design** – use and apply drawing skills.
- **Writing and computing** – write and record a radio advert, making use of persuasive writing features, sound effects and music to promote the final product or event it is advertising.
- **Computing** – children express themselves and develop ideas using a range of information and communication technology resources.
- **Spoken language** – consider and evaluate others' viewpoints. Give a well-structured oral evaluation to include relevant technical vocabulary.

20. Overall potential of project


Year 3

1. Year Groups
Years 3/4

2. Aspect of D&T
Mechanical systems

Focus

Levers and linkages

4. What could children design, make and evaluate?
story book | poster | class display | greetings card | information book | storyboard | other – specify

5. Intended users
themselves | younger children | older children | teenagers | parents | grandparents | visitor to school | friends | other – specify

6. Purpose of products
celebration event | information | pleasure | interests | hobbies | campaign | educational | other – specify

7. Links to topics/themes
Festivals and Celebrations | Favourite Books | history-based topic | geography-based topic | science-based topic | other – specify

8. Possible contexts
home | school | leisure | culture | enterprise | environment | local community | other – specify

9. Project title
Design, make and evaluate a _____ (product) for _____ (user) for _____ (purpose).

To be completed by the teacher. Use the project title to set the scene for children's learning prior to activities in 10, 12 and 14.

16. Possible resources
books and other products with lever and linkage mechanisms

lever and linkage teaching aids

card strips, card rectangles, paper, masking tape, paper fasteners, paper binders, stick glue

left/right handed scissors, cutting mats, card drill, finishing media and materials

17. Key vocabulary
mechanism, lever, linkage, pivot, slot, bridge, guide

system, input, process, output

linear, rotary, oscillating, reciprocating

user, purpose, function

prototype, design criteria, innovative, appealing, design brief

3. Key learning in design and technology

Prior learning
- Explored and used mechanisms such as flaps, sliders and levers.
- Gained experience of basic cutting, joining and finishing techniques with paper and card.

Designing
- Generate realistic ideas and their own design criteria through discussion, focusing on the needs of the user.
- Use annotated sketches and prototypes to develop, model and communicate ideas.

Making
- Order the main stages of making.
- Select from and use appropriate tools with some accuracy to cut, shape and join paper and card.
- Select from and use finishing techniques suitable for the product they are creating.

Evaluating
- Investigate and analyse books and, where available, other products with lever and linkage mechanisms.
- Evaluate their own products and ideas against criteria and user needs, as they design and make.

Technical knowledge and understanding
- Understand and use lever and linkage mechanisms.
- Distinguish between fixed and loose pivots.
- Know and use technical vocabulary relevant to the project.

10. Investigative and Evaluative Activities (IEAs)
- Children investigate, analyse and evaluate books and, where available, other products which have a range of lever and linkage mechanisms.
- Use questions to develop children's understanding e.g. *Who might it be for? What is its purpose? What do you think will move? How will you make it move? What part moved and how did it move? How do you think the mechanism works? What materials have been used? How effective do you think it is and why? What else could move?*

11. Related learning in other subjects
- **Spoken language** – participate in discussion and evaluation of books and, where available, other products with moving pictures. Ask relevant questions to extend knowledge and understanding. Build technical vocabulary.

12. Focused Tasks (FTs)
- Demonstrate a range of lever and linkage mechanisms to the children using prepared teaching aids.
- Use questions to develop children's understanding e.g. *Which card strip is the lever? Which card strip is acting as the linkage? Which part of the system is the input and which part the output? What does the type of movement remind you of? Which are the fixed pivots and which are the loose pivots?*
- Demonstrate the correct and accurate use of measuring, marking out, cutting, joining and finishing skills and techniques.
- Children should develop their knowledge and skills by replicating one or more of the teaching aids.

13. Related learning in other subjects
- **Mathematics** – use the vocabulary of position, direction and movement. Use a ruler to measure to the nearest cm, half cm or mm.
- **Spoken language** – ask relevant questions to extend knowledge and understanding. Build their technical vocabulary.
- **Art and design** – use colour, pattern, line, shape.

18. Key competencies
problem-solving | teamwork | negotiation | consumer awareness | organisation | motivation | persuasion | leadership | perseverance | other – specify

19. Health and safety
Pupils should be taught to work safely, using tools, equipment, materials, components and techniques appropriate to the task. Risk assessments should be carried out prior to undertaking this project.

14. Design, Make and Evaluate Assignment (DMEA)
- Develop a design brief with the children within a context which is authentic and meaningful.
- Discuss with children the purpose of the products they will be designing and making and who the products will be for. Ask the children to generate a range of ideas, encouraging creative responses. Agree on design criteria that can be used to guide the development and evaluation of the children's products.
- Using annotated sketches and prototypes, ask the children to develop, model and communicate their ideas.
- Ask the children to consider the main stages in making before assembling high quality products, drawing on the knowledge, understanding and skills learnt through IEAs and FTs.
- Evaluate the final products against the intended purpose and with the intended user, drawing on the design criteria previously agreed.

15. Related learning in other subjects
- **Spoken language** – ask relevant questions to extend knowledge and understanding. Build technical vocabulary. Consider and evaluate different viewpoints.
- **Computing** – digital graphics and text could be incorporated into final products as the background or moving parts.
- **Art and design** – use and develop drawing techniques. Use colour, pattern, line, shape.

20. Overall potential of project

Years 3/4

Mechanisms
Levers and linkages

Instant CPD

Tips for teachers

- ✓ Give children the opportunity to make examples of lever and linkage mechanisms though focused tasks.
- ✓ Preparing a plentiful supply of card strips can be useful to speed up the process.
- ✓ Card from recycled packaging is a cost-efficient way of providing enough material for children to experiment with different arrangements and to make mock-ups and prototypes.
- ✓ When working with thin card, a hole can be made for the paper fastener pivot by pressing a pencil through the card on to a piece of Plasticine or Blu Tack.
- ✓ A picture can be drawn on and cut out from another piece of card and glued on to the output levers.
- ✓ Windows can be cut out of the backing sheet or extra pieces added so that the picture on the output lever is hidden and then revealed.
- ✓ The backing sheet can be shaped to suit the picture.
- ✓ Guides/bridges can be made using strips of card fixed with masking tape e.g. white card on diagrams.
- ✓ Display technical vocabulary and encourage the children to use it when discussing mechanisms and when designing and making.
- ✓ Make sure the existing books children investigate include moving pictures that are similar to the teaching aids.

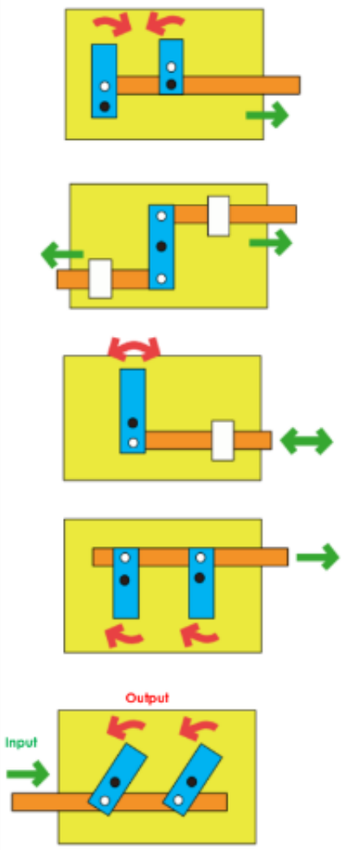
Useful resources at www.data.org.uk

- Levers and linkages - Poster and Support Pack
- Mechanisms with a message
- Moving history book

Teaching aids to demonstrate levers and linkages

Fixed pivot

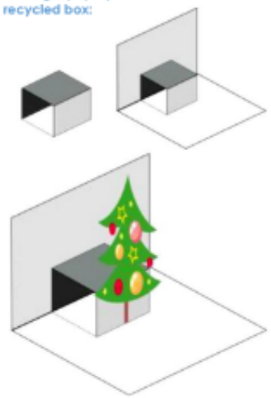
Loose pivot



When you push the card strip (input movement), the two levers move (output movement).

Pop-up mechanisms can be added to children's moving pictures as an enhancement. However, to build on work with simple levers and sliders in KS1, it is important to focus children's learning during this project on levers and

Making a pop-up from a small section of a recycled box:



1. Cut a slice off a small box.
2. Glue two sides to the paper.
3. Stick a picture to pop up on the front.

Lever and linkage mechanisms usually produce oscillating or reciprocating movement:

- Linear – in a straight line
- Reciprocating – backwards and forwards in a straight line e.g. a slider
- Rotary – round and round e.g. a wheel, cam, pulley, gear wheel
- Oscillating – backwards and forwards in an arc e.g. a lever

Designing, making and evaluating a greetings card with moving parts for family or friends

An iterative process is the relationship between a pupil's ideas and how they are communicated and clarified through activity. This is an example of how the iterative design and make process might be experienced by an individual pupil during this project:

THOUGHT	ACTION
What sort of greetings card shall I make and who will it be for? What part will move? How will it appeal to the user?	Discussing ideas, drawing annotated sketches, generating design crite
How will it move?	Discussing ideas, model possible lever and linka mechanisms.
Which lever and linkage mechanism will work best for my greetings card?	Discussing and evaluati mock-ups and prototyp against design criteria.
What media and materials will I use?	Discussing, exploring and trialing media and materials.
Who will I work with? How long will it take? What order will I work in? What tools and techniques will I use?	Negotiating, developing and agreeing a plan of action.
More thoughts ... appraising, reflecting, refining.	More actions ... building, testing, modifying.
Will the greetings card meet the needs of the user and achieve its purpose?	Evaluating the greetings card with the intended user and against design criteria.

Glossary

- **Mechanism** – a device used to create movement in a product.
- **Lever** – a rigid bar which moves around a pivot. Levers are used in many everyday products. In this project children will use card strips for levers and paper fasteners for pivots.
- **Linkage** – the card strips joining one or more levers to produce the type of movement required. The term 'linkage' is also used to describe the lever and linkage mechanism as a whole.
- **Slot** – the hole through which a lever is placed to enable part of a picture to move.
- **Guide or bridge** – a short card strip used to keep lever and linkage mechanisms in place and control movement.
- **Loose pivot** – a paper fastener that joins card strips together.
- **Fixed pivot** – a paper fastener that joins card strips to the backing card.
- **System** – a set of related parts or components used to create an outcome. Systems have an input, process and an output. In a lever and linkage mechanism, the 'input movement' is where the user pushes or pulls a card strip. The 'output movement' is where one or more parts of the picture move.

Years 5/6

Structures
Frame structures

Instant CPD

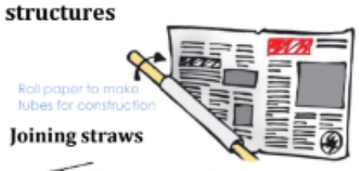
Tips for teachers

- ✓ Collect a range of photographs of different frame structures, both portable and permanent e.g. tents, bus shelters, bird hides.
- ✓ Include examples constructed with external and internal frameworks.
- ✓ Record the process of investigating frame structures using photographs and annotated drawings.
- ✓ Take children on a local 'frame structures' trail to help them get ideas for their own products and understand construction techniques.
- ✓ Frame structures for large scale shelters can be made from broom sticks, garden canes or rolls of newspaper.
- ✓ Ensure children are familiar with all the materials they are likely to use and that these are made easily available and accessible.
- ✓ Discuss constraints such as time, resources and cost.
- ✓ Display technical vocabulary and encourage children to use it when discussing, designing and making their product.
- ✓ Ensure children use simple tests to evaluate the functionality and strength of their products.
- ✓ Encourage the children to evaluate each other's work positively.

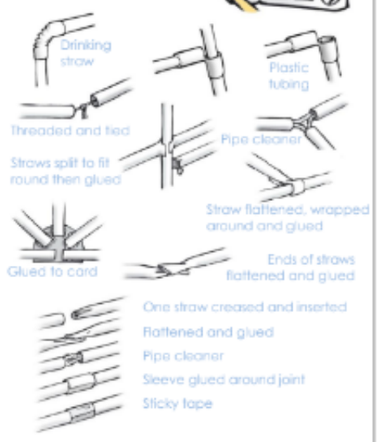
Useful resources at www.data.org.uk

- Primary Subject Leaders' File Section 5.9
- Bird Hides Dragons' Den Challenge
- Working with paper straws

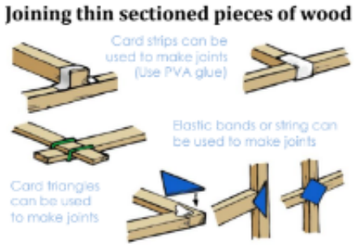
Techniques for building frame structures



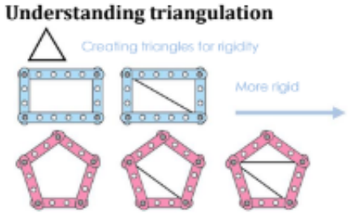
Joining straws



Joining thin sectioned pieces of wood

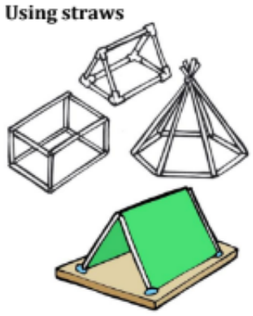


Understanding triangulation

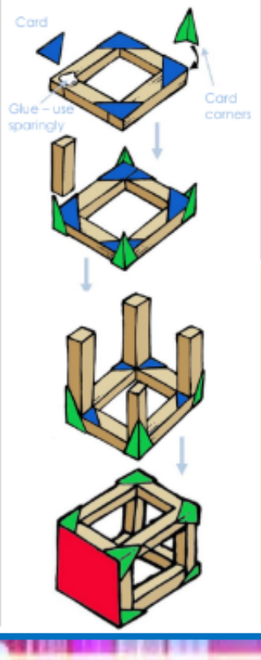


Making small-scale frame structures

Using straws



Using square section wood



Designing and making a small-scale bird hide for children to use in the school wildlife area

An iterative process is the relationship between a pupil's ideas and how they are communicated and clarified through activity. This is an example of how the iterative design and make process might be experienced by an individual pupil during this project:

THOUGHT	ACTION
What type of structure shall I make? What will be its purpose? Who will use it?	Discussing ideas, drawing annotated sketches. Generating a simple design specification.
Which will be the best shape for my bird hide? What features will it have?	Discussing, modelling and evaluating different options.
Which materials will I use to make it? How will I make it strong and waterproof?	Investigating and testing possible materials. Discussing, exploring and evaluating prototypes.
What will I use to cover the structure of my shelter?	Discussing, exploring and evaluating different fabric and rigid covering options.
What tools and materials will I need? What order will I work in? Will I work with someone? What constraints I am working to?	Negotiating, developing and agreeing a step-by-step plan.
Do I need to change anything?	Discussing, testing and modifying the design.
Will my product meet the needs of the user?	Evaluating the product with the intended user and against the original design specification.

Glossary

- **Modelling** – the process of making a 3-D representation of a structure or product.
- **Compression** – the application of pressure to squeeze an object.
- **Strut** – a part of a structure under compression.
- **Tension** – a force pulling on a material or structure.
- **Tie** – a part of a structure under tension.
- **Diagonal** – a straight line that goes from one corner to another inside a shape.
- **Horizontal** – a line that is parallel to the ground.
- **Vertical** – a line that is at right angles to the ground.
- **Triangulation** – the use of triangular shapes to strengthen a structure.
- **Frame structure** – a structure made from thin components e.g. tent frame.

1. Year Groups
Years 5/6

2. Aspect of D&T
Structures

Focus

Frame structures

3. Key learning in design and technology

Prior learning
- Experience of using measuring, marking out, cutting, joining, shaping and finishing techniques with construction materials.
- Basic understanding of what structures are and how they can be made stronger, stiffer and more stable.

Designing
- Carry out research into user needs and existing products, using surveys, interviews, questionnaires and web-based resources.
- Develop a simple design specification to guide the development of their ideas and products, taking account of constraints including time, resources and cost.
- Generate, develop and model innovative ideas, through discussion, prototypes and annotated sketches.

Making
- Formulate a clear plan, including a step-by-step list of what needs to be done and lists of resources to be used.
- Competently select from and use appropriate tools to accurately measure, mark out, cut, shape and join construction materials to make frameworks.
- Use finishing and decorative techniques suitable for the product they are designing and making.

Evaluating
- Investigate and evaluate a range of existing frame structures.
- Critically evaluate their products against their design specification, intended user and purpose, identifying strengths and areas for development, and carrying out appropriate tests.
- Research key events and individuals relevant to frame structures.

Technical knowledge and understanding
- Understand how to strengthen, stiffen and reinforce 3-D frameworks.
- Know and use technical vocabulary relevant to the project.

4. What could children design, make and evaluate?
playground shelter market stall bus shelter tent play house gazebo bird hide parasol park furniture adventure playground equipment kite other – specify

5. Intended users
themselves parents younger/older children local community walkers market trader gardeners mountaineers bird watchers other – specify

6. Purpose of products
safety weather protection play pleasure meeting place business recreation other – specify

7. Links to topics and themes
Shape and Space Festivals Celebrations Our School Toys and Games Outdoors Our Local Community Weather Countries and Cultures other – specify

8. Possible contexts
home school gardens leisure culture local community wider environment other – specify

9. Project title
Design, make and evaluate a _____ (product) for _____ (user) for _____ (purpose).
To be completed by the teacher. Use the project title to set the scene for children's learning prior to activities in 10, 12 and 14.

10. Investigative and Evaluative Activities (IEAs)
- Children investigate and make annotated drawings of a range of portable and permanent frame structures, e.g. tents, bus shelters, umbrellas. Use photographs and web-based research to extend the range e.g. *How well does the frame structure meet users' needs and purposes? Why were materials chosen? What methods of construction have been used? How has the framework been strengthened, reinforced and stiffened? How does the shape of the framework affect its strength? How innovative is the design? When was it made? Who made it? Where was it made?*
- Children could research key events and individuals related to their study of frame structures e.g. Stephen Sauvestre – a designer of the Eiffel Tower; Thomas Farnolls Pritchard – designer of the Iron Bridge. They could also learn about locally important design and technology activity related to their project.

11. Related learning in other subjects
- **Science** – compare and group together everyday materials on the basis of their properties.
- **Mathematics** – identify 3-D shapes, including cubes and other cuboids, from 2-D representations.
- **Spoken language** – ask relevant questions, formulate and express opinions, give well-structured descriptions and explanations. Use relevant strategies to build their vocabulary.
- **Computing** – use technologies for research purposes and be discerning when evaluating digital content.

12. Focused Tasks (FTs)
- Use a construction kit consisting of plastic strips and paper fasteners to build 2-D frameworks. Compare the strength of square frameworks with triangular frameworks. Ask the children to reinforce square frameworks using diagonals to help develop an understanding of using triangulation to add strength to a structure.
- Demonstrate how paper tubes can be made from rolling sheets of newspaper diagonally around pieces of e.g. dowel. Ask children to use these tubes and masking tape or paper straws with pipe cleaners to build 3-D frameworks such as cubes, cuboids and pyramids. *How could each of the frameworks be reinforced and strengthened?*
- Demonstrate the accurate use of tools and equipment. Develop skills and techniques using junior hacksaws, G-clamps, bench hooks, square section wood, card triangles and hand drills to construct wooden frames, as appropriate.
- Demonstrate skills and techniques for accurately joining framework materials together e.g. paper straws, square sectioned wood. Ask children to practise these, mounting their joints onto card for future reference.

13. Related learning in other subjects
- **Mathematics** – recognise, describe and build simple 3-D shapes. Apply understanding and skill to carry out accurate measuring using standard units i.e. cm/mm.
- **Spoken language** – ask relevant questions, formulate and express opinions, give well-structured descriptions and explanations. Use strategies to build their vocabulary.

14. Design, Make and Evaluate Assignment (DMEA)
- Discuss the brief of designing and making a small-scale frame structure e.g. *Who is the intended user and what is the purpose of the frame structure? Will it be permanent, or can it be easily dismantled? What materials will you use? How will it be joined? How will it be reinforced? How will it be finished?* Children should be encouraged to generate innovative ideas, drawing on their research. Ask children to develop a simple design specification to guide their thinking.
- Children should produce a detailed, step-by-step plan, listing tools and materials.
- Children's sketches should be annotated with notes to help develop and communicate their ideas.
- Encourage children to model their ideas first using materials such as paper, card and paper straws e.g. *How will you make it stable? How will it stand up? How could you make it stronger? Where are the weak points? How could you reinforce them? What tools and materials will you need? How can you improve the design?*
- Encourage children to make their products with accuracy. They should regularly evaluate their work and their completed product, drawing on their design specification, and thinking about the intended purpose and user.

15. Related learning in other subjects
- **Spoken language** – ask relevant questions, formulate and express opinions, give well-structured descriptions and explanations. Use strategies to build their vocabulary.
- **Art and design** – use and develop drawing skills.
- **Mathematics** – apply understanding and skill to carry out accurate measuring using standard units i.e. cm/mm.

16. Possible resources
products, photographs, web-based resources of existing frame structures

card, paper straws, newspaper, square sectioned wood, masking tape, PVA glue pencils, rulers, right/left handed scissors, bench hooks, G-clamp, junior hacksaws, glass paper

finishing media and materials

17. Key vocabulary
frame structure, stiffen, strengthen, reinforce, triangulation, stability, shape, join, temporary, permanent

design brief, design specification, prototype, annotated sketch, purpose, user, innovation, research, functional

18. Key competencies
problem-solving teamwork negotiation consumer awareness organisation motivation persuasion leadership perseverance other – specify

19. Health and safety
Pupils should be taught to work safely, using tools, equipment, materials, components and techniques appropriate to the task. Risk assessments should be carried out prior to undertaking this project.

20. Overall potential of project


1. Year Groups
Years 3/4

2. Aspect of D&T
Food

Focus

Healthy and varied diet

3. Key learning in design and technology

Prior learning
- Know some ways to prepare ingredients safely and hygienically.
- Have some basic knowledge and understanding about healthy eating and *The eatwell plate.*
- Have used some equipment and utensils and prepared and combined ingredients to make a product.

Designing
- Generate and clarify ideas through discussion with peers and adults to develop design criteria including appearance, taste, texture and aroma for an appealing product for a particular user and purpose.
- Use annotated sketches and appropriate information and communication technology, such as web-based recipes, to develop and communicate ideas.

Making
- Plan the main stages of a recipe, listing ingredients, utensils and equipment.
- Select and use appropriate utensils and equipment to prepare and combine ingredients.
- Select from a range of ingredients to make appropriate food products, thinking about sensory characteristics.

Evaluating
- Carry out sensory evaluations of a variety of ingredients and products. Record the evaluations using e.g. tables and simple graphs.
- Evaluate the ongoing work and the final product with reference to the design criteria and the views of others.

Technical knowledge and understanding
- Know how to use appropriate equipment and utensils to prepare and combine food.
- Know about a range of fresh and processed ingredients appropriate for their product, and whether they are grown, reared or caught.
- Know and use relevant technical and sensory vocabulary appropriately.

4. What could children design, make and evaluate?
sandwiches wraps rolls pitta pockets blinis rice cakes toasties snack bar salad snacks other – specify

5. Intended users
themselves older children younger children parents grandparents friends family visitors other – specify

6. Purpose of products
celebration picnic lunch boxes sports day religious festival off-site visits healthy living other – specify

7. Links to topics and themes
Stories Picnics Healthy Eating School Fair Religious Festival Eco-Fair/Green Days Cultural Focus day other – specify

8. Possible contexts
home school off-site educational visits leisure culture enterprise industry wider environment health other – specify

9. Project title
Design, make and evaluate a_____ (product) for _____ (user) for _____ (purpose).
To be completed by the teacher. Use the project title to set the scene for children's learning prior to activities in 10, 12 and 14.

10. Investigative and Evaluative Activities (IEAs)
- Children investigate a range of food products e.g. the content of their lunchboxes over a week, a selection of foods provided for them, food from a visit to a local shop. Link to the principles of a varied and healthy diet using *The eatwell plate* e.g. *What ingredients have been used? Which food groups do they belong to? What substances are used in the products e.g. nutrients, water and fibre?*
- Carry out sensory evaluations on the contents of the food from e.g. a variety of bought food products such as a range of wraps or sandwiches. Record results, for example using a table. Use appropriate words to describe the taste/smell/texture/appearance e.g. *How do the sensory characteristics affect your liking for the food?*
- Gather information about existing products available relating to your product. Visit a local supermarket and/or use the internet.
- Find out how a variety of ingredients used in products are grown and harvested, reared, caught and processed e.g. *Where and when are the ingredients grown? Where do different meats/fish/cheese/eggs come from? How and why are they processed?*

11. Related learning in other subjects
- **Mathematics and computing** – making use of mathematical and computing skills to present results of sensory evaluations graphically.
- **Spoken language** – developing relevant vocabulary e.g. sensory descriptors. Ask relevant questions to extend their knowledge.
- **Science** – using and developing skills of observing and questioning. Humans get nutrition from what they eat. Discuss changes of state if heat is used.

12. Focused Tasks (FTs)
- Learn to select and use a range of utensils and use a range of techniques as appropriate to prepare ingredients hygienically including the bridge and claw technique, grating, peeling, chopping, slicing, mixing, spreading, kneading and baking.
- Food preparation and cooking techniques could be practised by making a food product using an existing recipe.
- Discuss basic food hygiene practices when handling food including the importance of following instructions to control risk e.g. *What should we do before we work with food? Why is following instructions important?*

13. Related learning in other subjects
- **Mathematics** – mass kg/g.
- **Spoken language** – developing relevant technical vocabulary e.g. names of utensils and techniques. Ask relevant questions to extend their knowledge.

14. Design, Make and Evaluate Assignment (DMEA)
- Discuss the purpose of the products that the children will be designing, making and evaluating and who the products will be for.
- Develop and agree on design criteria with the children within a context that is authentic and meaningful. This can include criteria relating to healthy eating and a varied diet e.g. *What do you need to consider to make it part of a balanced diet? How do we select the ingredients? How could we make it appealing to eat?*
- Ask children to generate a range of ideas encouraging realistic responses.
- Using discussion, annotated sketches and information and communication technology if appropriate, ask the children to develop and communicate their ideas.
- Ask children to consider the main stages in making the food product, before preparing/cooking the product including the ingredients and utensils they will need.
- Evaluate as the assignment proceeds and the final product against the intended purpose and user, reflecting on the design criteria previously agreed. Consider what others think of the product when considering how the work might be improved.

15. Related learning in other subjects
- **Mathematics** – mass kg/g.
- **Art and Design** – using and developing drawing skills.
- **Writing** – new vocabulary. Use non-fiction texts such as description, explanation and instructions e.g. recipes. Organise their work using e.g. headings, subheadings.
- **Spoken language** – consider and evaluate different viewpoints. Use discussion to develop understanding through exploring ideas.

16. Possible resources
information about foods from around the world, basic recipes

range of relevant example foods to taste and evaluate

suitable equipment and utensils such as: knives, chopping board, weighing scales, measuring jugs, bowls, baking trays, spoons – various sizes, parchment paper, plastic film

17. Key vocabulary
name of products, names of equipment, utensils, techniques and ingredients

texture, taste, sweet, sour, hot, spicy, appearance, smell, preference, greasy, moist, cook, fresh, savoury

hygienic, edible, grown, reared, caught, frozen, tinned, processed, seasonal, harvested healthy/varied diet

planning, design criteria, purpose, user, annotated sketch, sensory evaluations

18. Key competencies
problem-solving teamwork negotiation consumer awareness organisation motivation persuasion leadership perseverance other – specify

19. Health and safety
Pupils should be taught to work safely and hygienically, using tools, equipment, techniques and ingredients appropriate to the task. Prior to undertaking this project risk assessments should be carried out, including identifying whether there are children who are not permitted to taste or handle any food ingredients or products.

20. Overall potential of project

Years 3/4

Food
Healthy and varied diet

Instant CPD

Tips for teachers

- ✓ When choosing bought products to evaluate, choose some with simple fillings (such as cheese) and others with more variety (such as bacon, lettuce and tomato). Include some with fillings from a variety of cultures.
- ✓ Children may need help to develop design criteria for their product. You can model this by discussing what the design criteria may have been for an existing product that the children have previously evaluated before encouraging them to create their own.
- ✓ If you grow edible plants in the school grounds such as herbs, lettuce or tomatoes, encourage the children to use these in their food product. When possible, use some ingredients which are seasonal and locally sourced.
- ✓ It is advisable to have additional adult support when children are learning to prepare ingredients.
- ✓ Use a range of fresh and processed ingredients.
- ✓ Some ingredients can be cooked using a heat source with adult supervision to introduce children to techniques such as boiling an egg or roasting a pepper.
- ✓ Hygiene: tie long hair back, wear aprons, cover cuts with blue plasters and wash hands thoroughly with soap and dry with a paper towel. More details on www.foodafactoflife.org.uk.
- ✓ Homework idea 1: Ask children to collect pictures of related food products from magazines etc. Research which similar products are used around the world.
- ✓ Homework idea 2: Ask members of the children's family which is their favourite lunch snack and why.

Useful resources at www.data.org.uk

- Dips and Dippers
- Super Salads
- Sandwich Snacks adapted for SEN
- Soups - Celebrating culture and seasonality

Other useful web-based resources:

- www.foodafactoflife.org.uk
- http://www.nhs.uk/livewell/5aday/pages/5adayhome.aspx
- www.eatwell.gov.uk

Wraps

Pitta bread sandwich

Sandwich

Skills and techniques

Grating cheese

Spreading butter on bread

Cutting using the bridge technique

Cutting using the claw technique

Investigating and Evaluating Activities

Children can analyse existing products related to their project using sensory evaluations and record their results in a table. Explain that tasting is not the same as eating. Provide kitchen towel so children can spit out food they do not like. Provide water to cleanse palette between tasting products.

Analysing existing products

Filling	Appearance	Smell	Flavour/ Taste	Texture	Dislike	Neither	Like
1							
2							
3							
4							
Word bank	Colourful Dark/pale Greasy Moist	Fruity Meaty Smoky Oniony Garlicky Fishy	Salty Herby Spicy Fishy Smoky	Crispy Crunchy Soft Chewy Sticky Smooth Hard			

Designing, making and evaluating a bread-based product with a filling for lunch, such as a wrap, a sandwich, a roll, a blini or a toastie

An iterative process is the relationship between a pupil's ideas and how they are communicated and clarified through activity. This is an example of how the iterative design and make process might be experienced by an individual pupil during this project:

THOUGHT	ACTION
Who am I making the food product for? How can I make it appealing for the range of users?	Discussing and communicating ideas, researching existing products, drawing annotated sketches, generating design criteria.
What kind of food product shall I make that can be carried easily? What ingredients could it contain?	Referring back to sensory evaluations carried out in IEAs.
How will I make sure it looks appealing as well as tastes and smells good?	Discussing ideas and how the type of food product and way it is eaten will affect the design.
What techniques will I use to prepare the ingredients and what equipment do I need?	Peeling, chopping, slicing, grating, spreading. Using tools such as round ended knives, vegetable peelers, apple corers, strawberry hullers and graters.
How long will it take? What order will I work in?	Listing the equipment required. Planning the order of the activity and timescale.
More thoughts... appraising, reflecting and refining.	Acting on ongoing evaluation to make appropriate changes.
Has the snack met the needs of the user and achieved its purpose?	Evaluating the food product against the design criteria including the user and purpose. Recording final product through an annotated sketch.

Glossary

- **Appearance** – how the food looks to the eye.
- **Texture** – how the product feels in the mouth.
- **Sensory evaluation** – evaluating food products in terms of the taste, smell, texture and appearance.
- **Preference test** – trying different foods and deciding which you like best.
- **Strawberry huller** – tool to remove the stalk and leaves from a strawberry.
- **Processed food** – ingredients that have been changed in some way to enable them to be eaten or used in food preparation and cooking.

1. Year Groups

Years 5/6

2. Aspect of D&T

Food

Focus

Celebrating culture and seasonality

3. Key learning in design and technology

Prior learning

- Have knowledge and understanding about food hygiene, nutrition, healthy eating and a varied diet.
- Be able to use appropriate equipment and utensils, and apply a range of techniques for measuring out, preparing and combining ingredients.

Designing

- Generate innovative ideas through research and discussion with peers and adults to develop a design brief and criteria for a design specification.
- Explore a range of initial ideas, and make design decisions to develop a final product linked to user and purpose.
- Use words, annotated sketches and information and communication technology as appropriate to develop and communicate ideas.

Making

- Write a step-by-step recipe, including a list of ingredients, equipment and utensils
- Select and use appropriate utensils and equipment accurately to measure and combine appropriate ingredients.
- Make, decorate and present the food product appropriately for the intended user and purpose.

Evaluating

- Carry out sensory evaluations of a range of relevant products and ingredients. Record the evaluations using e.g. tables/graphs/charts such as star diagrams.
- Evaluate the final product with reference back to the design brief and design specification, taking into account the views of others when identifying improvements.
- Understand how key chefs have influenced eating habits to promote varied and healthy diets.

Technical knowledge and understanding

- Know how to use utensils and equipment including heat sources to prepare and cook food.
- Understand about seasonality in relation to food products and the source of different food products.
- Know and use relevant technical and sensory vocabulary.

4. What could children design, make and evaluate?

bread pizza savoury biscuits
savoury scones savoury muffin
cereal snack soup other – specify

5. Intended users

themselves younger children parents
older people grandparents visitors
people with special dietary needs
consumers from a variety of cultures
other – specify

6. Purpose of products

festival celebration special event for sale
food for travel picnic visit other – specify

7. Links to topics and themes

Festivals Cultures/Celebrating Diversity
Celebrations Special Events Seasons
Sustainability Food Our Local Community
other – specify

8. Possible contexts

home school leisure culture
traditions enterprise healthy eating
local environment/community sustainability
wider environment global citizenship
other – specify

9. Project title

Design, make and evaluate a_____ (product) for _____ (user) for _____ (purpose)

To be completed by the teacher. Use the project title to set the scene for children's learning prior to activities in 10, 12 and 14.

10. Investigative and Evaluative Activities (IEAs)

- Children use first hand and secondary sources to carry out relevant research into existing products to include personal/cultural preferences, ensuring a healthy diet, meeting dietary needs and the availability of locally sourced/seasonal/organic ingredients. This could include a visit to a local bakery, farm, farm shop or supermarket e.g. *What ingredients are sourced locally/in the UK/from overseas? What are the key ingredients needed to make a particular product? How have ingredients been processed? What is the nutritional value of a product?*
- Children carry out sensory evaluations of a variety of existing food products and ingredients relating to the project. The ingredients could include those that could be added to a basic recipe such as herbs, spices, vegetables or cheese. These could be locally sourced, seasonal, Fair Trade or organic. Present results in e.g. tables/graphs/charts and by using evaluative writing.
- Use a range of questions to support children's ability to evaluate food ingredients and products e.g. *What ingredients help to make the product spicy/crisp/crunchy etc? What is the impact of added ingredients/finishes/shapes on the finished product?*
- Research key chefs and how they have promoted seasonality, local produce and healthy eating.

11. Related learning in other subjects

- **Mathematics and computing** – making use of mathematical and computing skills to present results of sensory evaluations graphically, handling and interpreting data.
- **Spoken language** – developing relevant vocabulary including sensory descriptors. Give well-structured explanations.
- **Science** – using and developing skills of observing, questioning, changing state of ingredients.
- **Geography** – distribution of natural resources i.e. food.
- **Computing** – use technology purposefully to retrieve digital content.

12. Focused Tasks (FTs)

- Demonstrate how to measure out, cut, shape and combine e.g. knead, beat, rub and mix ingredients.
- Demonstrate how to use appropriate utensils and equipment that the children may use safely and hygienically.
- Techniques could be practised following a basic recipe to prepare and cook a savoury food product.
- Ask questions about which ingredients could be changed or added in a basic recipe such as types of flour, seeds, garlic, vegetables. Consider texture, taste, appearance and smell.
- When using a basic dough recipe, explore making different shapes to change the appearance of the food product e.g. *Which shape is most appealing and why?*

13. Related learning in other subjects

- **Science** – properties of materials and changes of state.
- **Mathematics** – measuring mass kg/g. Understand and use approximate equivalences between metric and imperial units.
- **Spoken language** – new technical vocabulary.

14. Design, Make and Evaluate Assignment (DMEA)

- Develop a design brief and simple design specification with the children within a context that is authentic and meaningful. This can include design criteria relating to nutrition and healthy eating.
- Discuss the purpose of the products that the children will be designing, making and evaluating and who the products will be for.
- Ask children to generate a range of ideas encouraging innovative responses. Agree on design criteria that can be used to guide the development and evaluation of the children's product.
- Using annotated sketches, discussion and information and communication technology if appropriate, ask children to develop and communicate their ideas.
- Ask children to record the steps, equipment, utensils and ingredients for making the food product drawing on the knowledge, understanding and skills learnt through IEAs and FTs.
- Evaluate the work as it progresses and the final product against the intended purpose and user reflecting on the design specification previously agreed.

15. Related learning in other subjects

- **Mathematics** – measurement of mass kg/g; understand and use approximate equivalence of metric and imperial units.
- **Art and design** – using and developing drawing skills.
- **Spoken language** – articulate and justify answers and opinions. Listen and respond to adults and peers.
- **Writing** – purpose of writing e.g. for planning and evaluation.
- **Mathematics** – measurement of mass kg/g.
- **Science** – recognise the impact of diet on the way their bodies function.

16. Possible resources

information about food from around the world

video clips of foods in the context of where they come from, used and eaten

range of relevant examples of foods to taste and evaluate

basic recipes

suitable equipment and utensils to make and cook recipes such as: weighing scales, measuring jugs, bowls, spoons – various sizes, baking trays, parchment paper, plastic film

17. Key vocabulary

ingredients, yeast, dough, bran, flour, wholemeal, unleavened, baking soda, spice, herbs

fat, sugar, carbohydrate, protein, vitamins, nutrients, nutrition, healthy, varied, gluten, dairy, allergy, intolerance, savoury, source, seasonality

utensils, combine, fold, knead, stir, pour, mix, rubbing in, whisk, beat, roll out, shape, sprinkle, crumble

design specification, innovative, research, evaluate, design brief

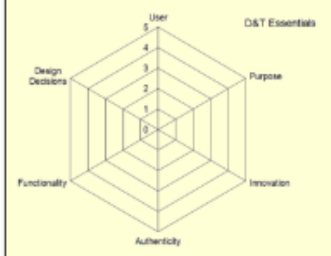
18. Key competencies

problem-solving teamwork negotiation
consumer awareness organisation motivation
persuasion leadership perseverance
other – specify

19. Health and safety

Pupils should be taught to work safely and hygienically, using tools, equipment, techniques and ingredients appropriate to the task. Prior to undertaking this project risk assessments should be carried out, including identifying whether there are children who are not permitted to taste or handle any food ingredients or products.

20. Overall potential of project



Years 5/6

Mechanical systems Cams

Instant CPD

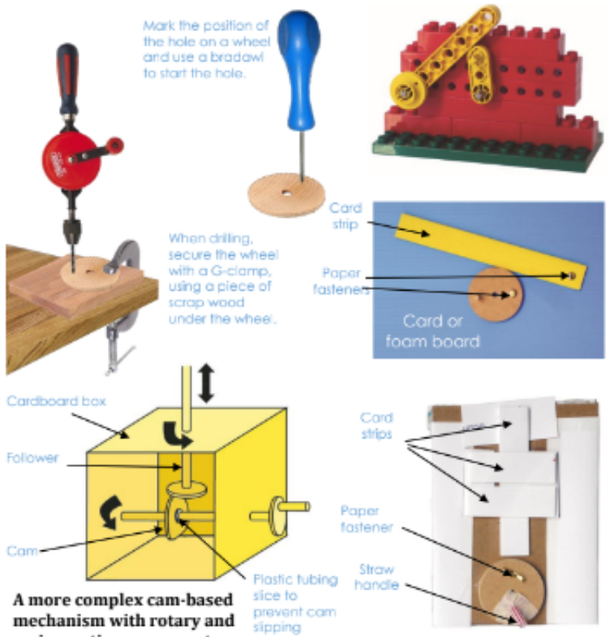
Tips for teachers

- ✓ Finding existing products that have cams on show can be difficult and they may have to be deconstructed to show the parts. Make example products using construction kits or consumable materials for children to investigate.
- ✓ Easy teaching aids can be made by mounting wheels on cardboard, foam board or corrugated plastic sheet. Card or foam wheels are easy to cut to different shapes.
- ✓ Avoid decorating teaching aids as this can influence the children's designs. Encourage discussion about what could move up and down and in rotation.
- ✓ Use pre-drilled wheels if time is limited and children have already had experience of using a hand drill.
- ✓ When making a cam and lever mechanism, remember the distance between the cam and the pivot point of the lever will affect the amount of movement, with more movement close to the pivot.
- ✓ When making a cam and slider mechanism, position the cam, slider and guides correctly. Measure where the cam will go to at the base of its cycle so that it does not overlap the bottom of the board. The guides should be positioned so that there is enough clearance for the cam to turn at the top of its cycle.
- ✓ When children are making, zone areas of the classroom so resources can be easily found and replaced independently.
- ✓ Investigate alternative methods of evaluating. Try making video or photographic diaries that help develop ongoing evaluation.
- ✓ Don't be afraid to include any failed designs into displays of final products. Include evaluations of why the designs didn't work and how children would make them work. This links to design in the real world and the concept that designs don't always work first time around.

Useful resources at www.data.org.uk

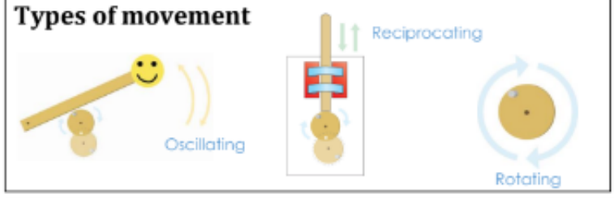
- Primary Subject Leaders' File Section 5.8
- Levers and Linkages
- Working with wheels and axles
- Mechanisms with a message
- Gears and Pulleys
- Fairgrounds

Making teaching aids to demonstrate cams

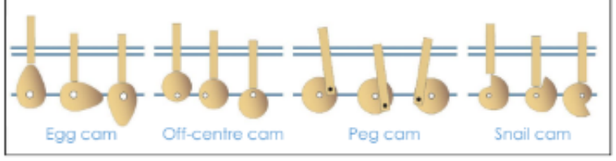


A more complex cam-based mechanism with rotary and reciprocating movement.

Types of movement



Types of cams



Designing, making and evaluating a moving toy for children in a particular age range

An iterative process is the relationship between a pupil's ideas and how they are communicated and clarified through activity. This is an example of how the iterative design and make process might be experienced by an individual pupil during this project:

THOUGHT	ACTION
What type of moving toy shall I make? What will be its purpose? Who will use it?	Discussing ideas, drawing annotated sketches or exploded diagrams Generating a simple design specification
What type of movement will it have? Will it be a moving vehicle or be stationary and have moving parts?	Discussing, modelling and evaluating different systems using mechanical components
Which materials will I use to make it? How will I make it fit for purpose?	Investigating and trialling possible materials and components
How will I make the body or housing for the moving parts?	Discussing, exploring and evaluating prototypes
What tools and materials will I need? What order will I work in? What constraints am I working to?	Negotiating, developing and agreeing a step-by-step plan
Do I need to change anything?	Discussing, testing and modifying the design
Will my product meet the needs, wants and interests of the user group?	Evaluating the product with the intended user group and against the original design specification

Glossary

- **Rotary motion** – movement that goes round.
- **Oscillating motion** – moving to and fro around a pivot point, as in a lever.
- **Reciprocating motion** - backwards and forwards movement in a straight line, as in a slider.
- **Cam** – a mechanism that changes one sort of movement to another. Cams can be an off-centre wheel or a specially shaped wheel.
- **Follower** – the device that follows the movement of the cam: a lever or a slider.
- **Lever** – a piece of rigid material that moves to and fro around a pivot point creating oscillating motion.
- **Slider** – a piece of rigid material that moves backwards and forwards in a straight line creating reciprocating motion.
- **Guide** – a piece of material used to guide the movement of another.
- **Spacer** – a piece of material used to create extra space to allow moving parts to move freely.

1. Year Groups

Years 3/4

2. Aspect of D&T

Structures

Focus

Shell structures using computer-aided design (CAD)

3. Key learning in design and technology

Prior learning

- Experience of using different joining, cutting and finishing techniques with paper and card.
- 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 Microsoft Word, or simple computer-aided design (CAD), such as 2D Primary by Techsoft.

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 shell structures and use computer-aided design to model and communicate ideas.

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.
- Use computer-generated finishing techniques suitable for the product they are creating.

Evaluating

- Investigate and evaluate a range of shell 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

- Develop and use knowledge of nets of cubes and cuboids and, where appropriate, more complex 3D shapes.
- Develop and use knowledge of how to construct strong, stiff shell structures.
- Know and use technical vocabulary relevant to the project.

4. What could children design, make and evaluate?

gift boxes desk tidy lunchboxes packaging
cool boxes party boxes mystery boxes
toy car body shell moneyboxes
other – specify

5. Intended users

themselves siblings parents relatives
friends younger/older children party guests
shop customers community group
neighbours other – specify

6. Purpose of products

packaging storage protection
marketing presentation display
celebration postage other – specify

7. Links to topics and themes

Shape and Space Shopping Going Green
Festivals Celebrations Healthy Eating
Our School Toys and Games
other – specify

8. Possible contexts

home school shopping culture
enterprise local community wider
environment other – specify

9. Project title

Design, make and evaluate a _____ (product) for _____ (user) for _____ (purpose).
To be completed by the teacher. Use the project title to set the scene for children's learning prior to activities in 10, 12 and 14.

10. Investigative and Evaluative Activities (IEAs)

- Children investigate a collection of different shell structures including packaging. Use questions to develop children's understanding e.g. *What is the purpose of the shell structure – protecting, containing, presenting? What material is it made from? How has it been constructed? Are the materials recyclable or reusable? How has it been stiffened i.e. folded, corrugated, ribbed, laminated? What size/shape/colour is it? What information does it show and why? How attractive is the design?*
- Children take a small package apart identifying and discussing parts of a net including the tabs e.g. *How are different faces of the package arranged? How are the tabs used to join the 'free' edges of the net?*
- Evaluate existing products to determine which designs children think are the most effective. Provide opportunities for the children to judge the suitability of the shell structures for their intended users and purposes. Discuss graphics including colours/impact of style/logo/size of font e.g. *What do you prefer and why? What style of graphics and lettering might we want to include in our product to meet users' preferences and its intended purpose? Which packaging might be the best for…?*

11. Related learning in other subjects

- **Science** – discuss the properties and suitability of materials for particular purposes.
- **Mathematics** – compare and sort common 2-D and 3-D shapes in everyday objects. Recognise 3-D shapes in different orientations and describe them.
- **Spoken language** – ask relevant questions to extend knowledge and understanding. Build their technical vocabulary.

12. Focused Tasks (FTs)

- Demonstrate simple drawing software such as Techsoft 2D Primary or Microsoft Word. Ask children to explore the interface and drawing tools to practise drawing and manipulating shapes such as rectangles, squares, ellipses, trapezoids and triangles.
- Ask children to use the software to open existing drawings including nets and to draw nets of their own, using gridlines and pre-shaped tools.
- Let the children explore and be guided to try out different fill and font tools to become familiar with the graphic design aspects of the available software to achieve the desired appearance of their products.
- Practise making nets out of card, joining flat faces with masking tape to create 3-D shapes. Experiment with assembling pre-drawn nets in numerous ways using scoring, cutting and assembling techniques. Allow children to construct a simple box and show how a window can be cut out and acetate sheet added.

13. Related learning in other subjects

- **Mathematics** – use a ruler to measure to the nearest cm, half cm or mm. Draw 2-D shapes and make 3-D objects using modelling materials.
- **Computing** – design and create digital content on screen, creating nets for their products and combining text with graphics.

14. 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 shell structure e.g. *What does the product need to do? Who is it aimed at? How will the purpose and user affect your design decisions?* Agree on design criteria that can be used to guide the development and evaluation of children's products e.g. *How will we know that we have designed and made successful products?*
- Ask the children to develop a design using computer-aided design (CAD) software to create nets, addressing the needs of the user and the purpose.
- Using computer-aided design (CAD) software ask the children to print out their nets to develop prototypes in order to evaluate and refine their ideas e.g. *What will you need to include in your design? How can you improve it? What materials will you use? How will you make sure your product works well and has the right appearance?*
- 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.

15. Related learning in other subjects

- **Spoken language** – ask relevant questions to extend knowledge and understanding. Build technical vocabulary.
- **Art and design** – use and develop drawing skills.
- **Writing** – write for real purposes and audiences.
- **Computing** – design and create digital content on screen using computer-aided design (CAD) software, creating nets for their products and combining graphics with text.

16. Possible resources

collection of shell structures for different purposes and users
card, squared paper, coloured paper, adhesive tape, masking tape, PVA glue, glue spreaders, acetate sheet, pencils, felt-tip pens, rulers, right/left handed scissors
computer with computer-aided design (CAD) software such as Techsoft 2D Primary or Microsoft Word, printer

17. Key vocabulary

shell structure, three-dimensional (3-D) shape, net, cube, cuboid, prism, vertex, edge, face, length, width, breadth, capacity
marking out, scoring, shaping, tabs, adhesives, joining, assemble, accuracy, material, stiff, strong, reduce, reuse, recycle, corrugating, ribbing, laminating
font, lettering, text, graphics, decision, evaluating, design brief design criteria, innovative, prototype

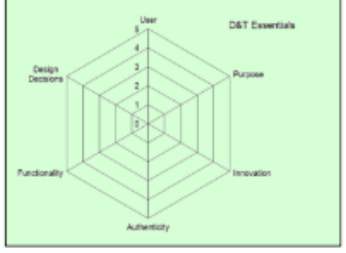
18. Key competencies

problem-solving teamwork negotiation
consumer awareness organisation motivation
persuasion leadership perseverance
other – specify

19. Health and safety

Pupils should be taught to work safely, using tools, equipment, materials, components and techniques appropriate to the task. Risk assessments should be carried out prior to undertaking this project.

20. Overall potential of project



Years 3/4

Structures
Shell structures using CAD

Instant CPD


Tips for teachers

- ✓ Please also refer to the Instant CPD guidance in 'Year 3/4 Structures – shell structures' when carrying out this project
- ✓ Many software packages have demonstration versions with tutorials that you can try out without paying a charge.
- ✓ Visit a local shop or supermarket to investigate different types of card packaging.
- ✓ Make a collection of shell structures of various shapes and, where possible, flatten them to show the nets and for storage.
- ✓ Put together an image board of packaging so children can see the range of fonts and consistency with a brand.
- ✓ Discuss environmental issues relating to the wastage of materials when packaging items including the three R's - reducing, recycling and reusing.
- ✓ If children are designing and making packages for a food product, they will need to choose materials appropriate for direct contact with food.
- ✓ You may want to restrict children to using particular standard shapes when designing their nets and final products.
- ✓ Ensure that the children include sufficient tabs in their drawings for assembling their nets.
- ✓ Use the options in Microsoft Word and other software to display rulers and grids that can help with generating nets and other items.
- ✓ Using copy and paste will ensure that objects are of a consistent size.
- ✓ Ensure that the children have a good understanding of the associated vocabulary and of 2-D and 3-D shapes in maths before carrying out this project.

Useful resources at www.data.org.uk

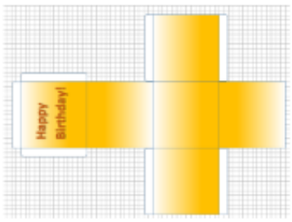
- Primary Subject Leaders' File Section 5.9
- Banish broken biscuits! Box them brilliantly
- Desk Tidy
- Working with Materials
- Packaging – with links to Maths
- Nets for packaging

Using Microsoft Word

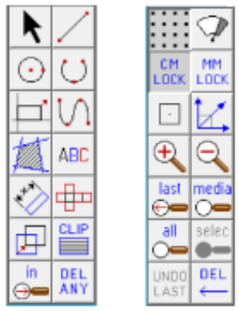
Turn on gridlines and use the pre-set shapes to draw simple nets. Shapes can be edited if you choose.

Text boxes and colouring using the format tab will allow children to come up with a range of designs.

Microsoft Word has many features that allow children to draw and manipulate accurate shapes, import or paste in graphics and print the final designs without having to use dedicated CAD software.

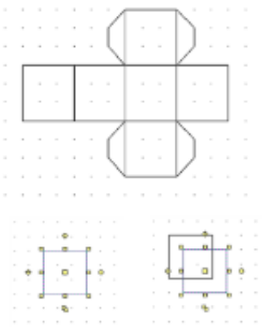


Using TechSoft 2D Primary



Explore and use the different drawing tools and zoom, grid and locking tools to help ensure accurate drawings.

Demonstrate how to draw a simple net and ask children to practise using the copy and move 'handles'.



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

Designing, making and evaluating CAD-based packaging to protect and display a food product for sale

An iterative process is the relationship between a pupil's ideas and how they are communicated and clarified through activity. This is an example of how the iterative design and make process *might* be experienced by an individual pupil during this project:

THOUGHT	ACTION
What product am I designing and making the packaging for? How will it safely protect the product? How will my product appeal to my intended user?	Discussing and researching ideas, generating design criteria, drawing annotated sketches
How can CAD help me make a package that is accurate, strong and appealing? Which materials will I use?	Investigating and evaluating possible tools and materials
Which shape(s) will be the best to keep the food safe? How will I strengthen my structure?	Discussing, constructing and comparing different nets Exploring strengthening techniques Evaluating prototypes against success criteria
How can I use CAD to get the graphic effects that I want?	Discussing, exploring, trialling and evaluating graphic effects
Will I work with someone else? How long will it take? What order will I work in? What tools, techniques and skills will I use?	Negotiating, developing and agreeing a plan of action, evaluating actions
Do I need to adjust or change anything?	Discussing, trying out and modifying the design
Will my product meet the needs of the user?	Evaluating the product with the intended user and against the success criteria

Glossary

- **CAD** – computer-aided design.
- **Shell structure** – a hollow structure with a thin outer covering.
- **Edge** – where two surfaces meet at an angle.
- **Face** – a surface of a geometric shape.
- **Vertex** – the corners of a geometric shape where edges meet.
- **Font** – a printer's term meaning the style of lettering being used.
- **Net** – the flat or opened-out shape of an object such as a box.
- **Cuboid** – a solid body with rectangular sides.
- **Prism** – a solid geometric shape with ends that are similar, equal and parallel.

Year 5

1. Year Groups
Years 5/6

2. Aspect of D&T
Mechanical systems
Focus
Cams

3. Key learning in design and technology

Prior learning
- Experience of axles, axle holders and wheels that are fixed or free moving.
- Basic understanding of different types of movement.
- Experience of cutting and joining techniques with a range of materials including card, plastic and wood.
- An understanding of how to strengthen and stiffen structures.

Designing
- Generate innovative ideas by carrying out research using surveys, interviews, questionnaires and web-based resources.
- Develop a simple design specification to guide their thinking.
- Develop and communicate ideas through discussion, annotated drawings, exploded drawings and drawings from different views.

Making
- Produce detailed lists of tools, equipment and materials. Formulate step-by-step plans and, if appropriate, allocate tasks within a team.
- Select from and use a range of tools and equipment to make products that that are accurately assembled and well finished. Work within the constraints of time, resources and cost.

Evaluating
- Compare the final product to the original design specification.
- Test products with the 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.
- Investigate famous manufacturing and engineering companies relevant to the project.

Technical knowledge and understanding
- Understand that mechanical systems have an input, process and an output.
- Understand how cams can be used to produce different types of movement and change the direction of movement.
- Know and use technical vocabulary relevant to the project.

4. What could children design, make and evaluate?
a shop display with moving parts e.g. lifting or rotating images of items for sale
a vehicle incorporating cam-driven components
a toy with oscillating, rotating or reciprocating movement
other – specify

5. Intended users
peers siblings younger children
older children shoppers
specific individuals target groups
company other – specify

6. Purpose of products
business entertainment pleasure play
educational interests and hobbies
other – specify

7. Links to topics and themes
Toys and Games
Forces and Motion
Festivals
other – specify
Our Community
Mini-enterprise
Celebrations

8. Possible contexts
shops home school local community
leisure enterprise wider environment
engineering manufacturing other – specify

9. Project title
Design, make and evaluate a _____ (product) for _____ (user) for _____ (purpose).

To be completed by the teacher. Use the project title to set the scene for children's learning prior to activities in 10, 12 and 14.

10. Investigative and Evaluative Activities (IEAs)
- Discuss with the children different types of movement: rotary, oscillating and reciprocating. Make simple models of different types of cams or have toys in which the cam mechanisms can be seen. Use videos, photographs and computer animations of products that cannot be explored through first-hand experience.
- Encourage children to look for different types of movement in the home and in school.
- Use observational drawings and questions to develop understanding of the products in the handling collection and those that children have researched e.g. *How innovative is the product? What design decisions have been made? What type of movement can be seen? What types of mechanical components are used and where are they positioned? What are the input movement, process and output movement of the system? How well does the product work? Why have the materials and components been chosen? How well has it been designed? How well has it been made?*
- Children could research and, if possible, visit engineering and manufacturing companies that are relevant to the product they are designing and making e.g. car engine manufacturers

11. Related learning in other subjects
- **Spoken language** – ask relevant questions, formulate and express opinions, give well-structured descriptions and explanations. Listen and respond appropriately, articulate and justify answers, arguments and opinions. Consider and evaluate different viewpoints.
- **Computing** – use search technologies for research purposes and be discerning when evaluating digital content.
- **Science** – forces and movement: explore the effects of simple machines on movement.

12. Focused Tasks (FTs)
- Give children pre-cut cams made from MDF or wooden wheels to mount on a piece of board and observe their movement with a follower.
- Demonstrate how to use a hand drill safely to make an off-centre cam and position it accurately in a housing. Ensure children secure the wheel with a G-clamp and use a piece of scrap wood under the wheel to avoid drilling through the bench hook or table. Stress the importance of measuring accurately and checking before cutting any holes or gluing. It is important to line up the cam and follower otherwise the mechanism may not work smoothly. *How high will the cam lift the follower?*
- Develop measuring, marking, cutting, shaping and joining skills using junior hacksaws, G-clamps, bench hooks, square section wood, card triangles and hand drills to make cam mechanisms and construct wooden frames or card housings, as appropriate. Demonstrate the accurate and safe use of tools and equipment.

13. Related learning in other subjects
- **Spoken language** – listen and respond appropriately. Use relevant strategies to build their vocabulary.
- **Science** – identify and compare the suitability of a variety of everyday materials for particular uses.
- **Mathematics** – use mathematical vocabulary to describe position, direction and movement.

14. Design, Make and Evaluate Assignment (DMEA)
- Develop an authentic and meaningful design brief with the children.
- Children generate innovative ideas by carrying out research including surveys, interviews and questionnaires and develop a design specification for their product, carefully considering the purpose and intended user for their product.
- Communicate ideas through detailed, annotated sketches from different views and/or exploded diagrams. The drawings should indicate the design decisions made, including the location of the components, how they work as a system and the appearance and finishing techniques for the product.
- 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. Children should use a range of decorative finishing techniques to ensure a well finished final product that matches the intended user and purpose.
- Evaluate throughout and the final product in use, comparing it to the original design specification. Critically evaluate the quality of the design, the manufacture, functionality, innovation shown and fitness for the intended user and purpose.

15. Related learning in other subjects
- **Art and design** – use and apply drawing skills. Use techniques with colour, pattern, texture, line and shape.
- **Science** – explore the effects of simple machines on movement.
- **Mathematics** – choose and use appropriate standard units (i.e. cm/mm) to estimate and accurately measure length/height.

16. Possible resources
videos and photographs of cams, models or toys with different cam mechanisms

MDF, card or wooden wheels, plastic or wooden cams, dowel, card boxes, PVA glue, masking tape, double-sided tape, square section wood, card, corrugated plastic, finishing media

junior hacksaws, glass paper, G-clamps, bench hooks, hand drill

17. Key vocabulary
cam, snail cam, off-centre cam, peg cam, pear shaped cam

follower, axle, shaft, crank, handle, housing, framework

rotation, rotary motion, oscillating motion, reciprocating motion

annotated sketches, exploded diagrams

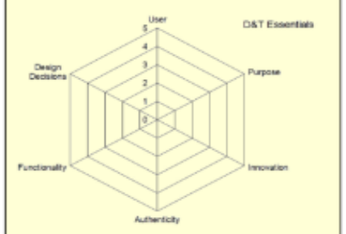
mechanical system, input movement, process, output movement

design decisions, functionality, innovation, authentic, user, purpose, design specification, design brief

18. Key competencies
problem-solving teamwork negotiation
consumer awareness organisation motivation
persuasion leadership perseverance
other – specify

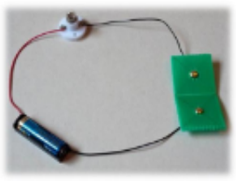
19. Health and safety
Pupils should be taught to work safely, using tools, equipment, materials, components and techniques appropriate to the task. Risk assessments should be carried out prior to undertaking this project.

20. Overall potential of project



Years 3/4 | **Electrical Systems**
Simple circuits and switches

Instant CPD




Tips for teachers

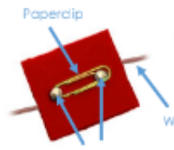
- ✓ This project should be undertaken either around the same time or soon after electricity is covered in science.
- ✓ Use a selection of images of existing battery-powered products to add to the actual products that children investigate and evaluate.
- ✓ Check the condition of the batteries prior to activities.
- ✓ Stress the need for making secure connections.
- ✓ To reduce the number of requests for help, model the fault-finding process: check all the connections, ensure that bulbs are screwed in tightly and ensure that components are correctly connected.
- ✓ Have a 'working' circuit set up so that children can test suspect components.
- ✓ Some components (e.g. buzzers) need to be connected the right way round in a circuit, ensuring positive and negative match the poles of the battery.
- ✓ Make sure bulbs and batteries match e.g. 1.5v bulb with a 1.5v battery.
- ✓ Do not use rechargeable batteries.
- ✓ CLEAPS recommend zinc carbon and zinc chloride batteries for Primary schools, not rechargeable, lithium of alkaline as these can overheat if short circuited. Button batteries are not recommended for younger children.

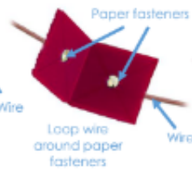
Useful resources at www.data.org.uk

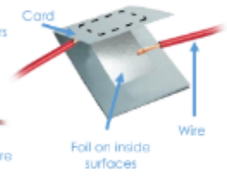
- Torches, Lamps and Lanterns
- Developing Handmade Switches
- Night lights (links to Literacy)
- Handmade Switches Helpsheet
- Alarming Vehicles

Making secure connections

Handmade switches







Commercial switches

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

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.

Reed switch
Activated by a magnet – this closes the contacts and completes the circuit.

Toggle switch
Simple on/off switch

Standalone control box

When children are familiar with using electrical circuits they should be introduced to a simple standalone control box or an interface box. The box will replace their switches and battery, and children can program their product to work automatically.

Designing, making and evaluating a night light for a brother, sister or friend

An iterative process is the relationship between a pupil's ideas and how they are communicated and clarified through activity. This is an example of how the iterative design and make process might be experienced by an individual pupil during this project:

Glossary

- **Circuit** – path through which electricity passes.
- **Conductor** – a material which allows an electric current to pass through it.
- **Insulator** – a material which does not easily allow electric current to pass through it.
- **Prototype** – a model made to test whether a design will work.
- **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.
- **Toggle switch** – a switch operated when a lever is pressed.
- **System** – a set of related parts or components that together achieve a desired outcome.
- **Output devices** – components that produce an outcome e.g. bulbs and buzzers.
- **Input devices** – components that are used to control an electrical circuit e.g. switches.

Year 4

1. Year Groups
Years 3/4

2. Aspect of D&T
Textiles

Focus
2-D shape to 3-D product

4. What could children design, make and evaluate?
purse/wallet soft toy/mascot apron fashion accessory beach bag shoe bag pencil case story sack other – specify

5. Intended users
themselves friends family teachers children parents other adults other – specify

6. Purpose of products
entertainment hobbies protection celebration pleasure carrying things other – specify

7. Links to topics and themes
Celebrations Festivals Make Do and Mend Holidays Sustainability Containers other – specify

8. Possible contexts
school home leisure enterprise sustainability outdoor environment other – specify

9. Project title
Design, make and evaluate a _____ (product) for _____ (user) for _____ (purpose)
To be completed by the teacher. Use the project title to set the scene for children's learning prior to activities in 10, 12 and 14.

16. Possible resources
collection of textile products linked to the chosen product to be made

selection of fabrics and fastenings

left/right handed scissors, needles, thread, tape, fabric glue, pins, measuring tape

items to use for finishing e.g. fabric paints, threads, appliqué pieces, paints for printing, thin paint brushes

17. Key vocabulary
fabric, names of fabrics, fastening, compartment, zip, button, structure, finishing technique, strength, weakness, stiffening, templates, stitch, seam, seam allowance

user, purpose, design, model, evaluate, prototype, annotated sketch, functional, innovative, investigate, label, drawing, aesthetics, function, pattern pieces

3. Key learning in design and technology

Prior learning
- Have joined fabric in simple ways by gluing and stitching.
- Have used simple patterns and templates for marking out.
- Have evaluated a range of textile products.

Designing
- Generate realistic ideas through discussion and design criteria for an appealing, functional product fit for purpose and specific user/s.
- Produce annotated sketches, prototypes, final product sketches and pattern pieces.

Making
- Plan the main stages of making.
- Select and use a range of appropriate tools with some accuracy e.g. cutting, joining and finishing.
- Select fabrics and fastenings according to their functional characteristics e.g. strength, and aesthetic qualities e.g. pattern.

Evaluating
- Investigate a range of 3-D textile products relevant to the project.
- Test their product against the original design criteria and with the intended user.
- Take into account others' views.
- Understand how a key event/individual has influenced the development of the chosen product and/or fabric.

Technical knowledge and understanding
- Know how to strengthen, stiffen and reinforce existing fabrics.
- Understand how to securely join two pieces of fabric together.
- Understand the need for patterns and seam allowances.
- Know and use technical vocabulary relevant to the project.

10. Investigative and Evaluative Activities (IEAs)
- Children investigate a range of textile products that have a selection of stitches, joins, fabrics, finishing techniques, fastenings and purposes, linked to the product they will design, make and evaluate. Think about products from the past and what changes have been made in textile production and products e.g. the invention of zips and Velcro.
- Give children the opportunity to disassemble appropriate textiles products to gain an understanding of 3-D shape, patterns and seam allowances.
- Use questioning to develop understanding e.g. *What is its purpose? Which one is most suited to its purpose? What properties/characteristics does the fabric have? Why has this fabric been chosen? How has the fabric been joined together? How effective are its fastenings? How has it been decorated? Does its decoration have a purpose? What would the 2-D pattern piece look like? What are its measurements? How might you change the product?*

11. Related learning in other subjects
- **Science** – physical properties of fabrics.
- **Spoken language** – asking and answering questions to develop understanding. Through discussion, participate actively initiating and responding to comments.
- **Mathematics** – nets of shapes and accurate measurements mm/cm.
- **History** – investigating textiles and textile products from age being studied.

12. Focused Tasks (FTs)
- Demonstrate a range of stitching techniques and allow children to practise sewing two small pieces of fabric together, demonstrating the use of, and need for, seam allowances.
- Allow children to use a textile product they have taken apart to create a paper pattern using 2-D shapes.
- Provide a range of fabrics – children to consider whether fabrics are suitable for the chosen purpose and user. The fabrics also can be used for demonstrating and testing out a range of decorative finishing techniques e.g. appliqué, embroidery, fabric pens/paints, printing.
- Use questioning to develop understanding e.g. *Which joining technique makes the strongest seam? Why? Which stitch is appropriate for the purpose? Which joining techniques are suitable for the fabric and purpose? How can you stiffen your fabric? What is the purpose of the fastenings? Which one is most suited to the purpose and user? What decorative techniques have been used? What effect do they have?*

13. Related learning in other subjects
- **Computing** – opportunity to create pattern pieces using a computer program.
- **Mathematics** – nets of shapes and accurate measurement mm/cm.
- **Science** - identify and compare the suitability of a variety of fabrics for particular uses.
- **Art and design** – investigating visual and tactile qualities of fabrics and using colour and pattern appropriately.
- **Spoken language** – develop technical vocabulary. Give well-structured descriptions of e.g. finishing techniques.

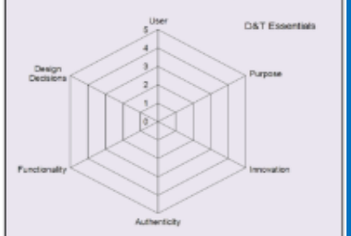
14. Design, Make and Evaluate Assignment (DMEA)
- Children to create a design brief, supported by the teacher, set within a context which is authentic and meaningful. Discuss the intended user, purpose and appeal of their product. Create a set of design criteria.
- Ask children to sketch and annotate a range of possible ideas, constantly encouraging creative thinking. Produce mock-ups and prototypes of their chosen product.
- Plan the main stages of making e.g. using a flowchart or storyboard.
- Children to assemble their product using their existing knowledge, skills and understanding from IEAs and FTs. Encourage children to think about the aesthetics and quality finish of their product.
- Evaluate as the process is undertaken and the final product in relation to the design brief and criteria. The product should be tested by the intended user and for its purpose and others' views sought to help with identifying possible improvements.

15. Related learning in other subjects
- **Art and design** – using a range of tools and decorative techniques. Develop sketching techniques.
- **Computing** – using software to produce pattern pieces and possible use for decorative techniques.
- **Mathematics** – accurate measurements mm/cm.
- **Spoken language** – consideration and evaluation of others' viewpoint.
- **Writing** – written evaluation of their product, organising it under e.g. headings, subheadings.

18. Key competencies
problem-solving teamwork negotiation consumer awareness organisation motivation persuasion leadership perseverance other – specify

19. Health and safety
Pupils should be taught to work safely, using tools, equipment, materials, components and techniques appropriate to the task. Risk assessments should be carried out prior to undertaking this project.

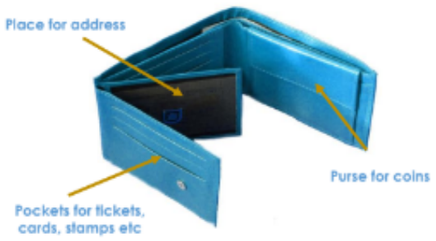
20. Overall potential of project



Years 3/4

Textiles
2-D shape to 3-D product

Instant CPD



Tips for teachers

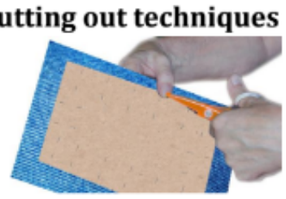
- ✓ Have simple patterns available for children who may find it difficult to create their own.
- ✓ Demonstrate stitching techniques and have help sheets showing stitch instructions for the children to practise independently.
- ✓ Complete sewing practice in small groups. Use adult helpers to provide additional support. Possibly set up a rotation of activities.
- ✓ Demonstrate finishing techniques; let the children practise on small pieces of fabric.
- ✓ Have a limited range of fasteners.
- ✓ Use recycled fabrics e.g. old clothing, ensuring they are easy to work with.
- ✓ Use dipryl or J-cloth type fabric for prototypes.
- ✓ Have a range of products and pictures for children to investigate. Try to use at least one product that can be disassembled so children can see all the parts.
- ✓ Games could be made with technical vocabulary cards e.g. pairs.

Useful resources at www.data.org.uk

- Aprons
- Fancy a bag?
- Designing with textiles
- Bendy bags (Years 1/2)
- A to Z of D&T
- Working with Materials

Teaching aids – joining techniques

Cutting out techniques



Ensure template is secured to fabric to allow for accuracy. Double sided tape can be used instead of pins to do this.

Place pattern pieces carefully to avoid wastage.

To move children's learning on, as enhancement activities, children could research into different types of fabrics and how they are constructed. They could carry out tests to check e.g. strength, waterproofness or flexibility to ensure their chosen fabric can be used to create a product that meets the needs of user and is fit for purpose.

Bonded

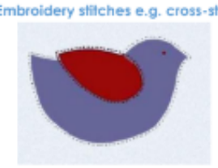
Woven

Knitted

Felted

Decorative Techniques

Embroidery stitches e.g. cross-stitch



Appliqué by gluing or stitching

Possible fastenings

Buttons

Velcro

Designing, making and evaluating a holder/purse/wallet for a friend or relative

An iterative process is the relationship between a pupil's ideas and how they are communicated and clarified through activity. This is an example of how the iterative design and make process *might* be experienced by an individual pupil during this project:

THOUGHT	ACTION
Who is it for? What will it hold? e.g. phone, money, plastic cards, pencils.	Discuss ideas: create a list of likes and dislikes of the user Generate design criteria
What shape will the holder be? How will it fasten?	Investigate a range of templates/patterns and choose the most appropriate one for purpose Create initial design ideas
What fabric should I use?	Discuss and explore different fabrics suitable for purpose Possibly test fabrics for strength/waterproofness
Which joining techniques would be the best for the fabric and pattern?	Discuss and test out different joining techniques on mock ups Evaluate these against the design criteria
How can I make my holder aesthetically pleasing for the user?	Test out a range of decorative techniques and decide on the one/s which are appropriate
How long will it take to make? What tools will I need? What order should I do it in?	Create the holder following the design
Reflection and refining What isn't working very well? What could I improve on?	Make suitable adjustment during the making process Develop the plan during the making
Will my holder/purse/wallet fulfil its function? Is it suitable for the user?	Test out the product Make an evaluation with the user against the initial design criteria and design ideas

Glossary

- **Appliqué** – means 'applied' - describes method of stitching/gluing patches onto fabric (originally to mend holes in worn clothes) to provide decoration.
- **Pattern/Template** – a shape drawn to exact shape and size and used to assist cutting out.
- **Seam** – a line of stitching that joins pieces of fabrics together.
- **Seam Allowance** – extra fabric allowed for joining together - usually 1.5cm.
- **Prototype** – a model that is made to test whether a design will work.
- **Aesthetics** – the way in which the product looks with the nature and expression of beauty.

1. Year Groups

Year 3/4

2. Aspect of D&T

Electrical systems
Focus
Simple circuits and switches

3. Key learning in design and technology

Prior learning
- Constructed a simple series electrical circuit in science, using bulbs, switches and buzzers.
- Cut and joined a variety of construction materials, such as wood, card, plastic, reclaimed materials and glue.

Designing
- Gather information about needs and wants, and develop design criteria to inform the design of products that are fit for purpose, aimed at particular individuals or groups.
- Generate, develop, model and communicate realistic ideas through discussion and, as appropriate, annotated sketches, cross-sectional and exploded diagrams.

Making
- Order the main stages of making.
- Select from and use tools and equipment to cut, shape, join and finish with some accuracy.
- Select from and use materials and components, including construction materials and electrical components according to their functional properties and aesthetic qualities.

Evaluating
- Investigate and analyse a range of existing battery-powered products.
- Evaluate their ideas and products against their own design criteria and identify the strengths and areas for improvement in their work.

Technical knowledge and understanding
- Understand and use electrical systems in their products, such as series circuits incorporating switches, bulbs and buzzers.
- Apply their understanding of computing to program and control their products.
- Know and use technical vocabulary relevant to the project.

4. What could children design, make and evaluate?
siren for a toy vehicle reading light noise-making toy nightlight illuminated sign torches table lamp lighting for display hands-free head lamp buzzer for school office other – specify

5. Intended users
themselves younger children older children teenagers parents grandparents friends school general public other – specify

6. Purpose of products
safety and security hobbies and interests utility pleasure advertising gift energy saving for sale other – specify

7. Links to topics and themes
Homes Travel and Holidays Cities Emergency Vehicles School Business Enterprise Light and Dark other – specify

8. Possible contexts
home school leisure culture enterprise environment sustainability local community other – specify

9. Project title
Design, make and evaluate a _____ (product) for _____ (user) for _____ (purpose)

To be completed by the teacher. Use the project title to set the scene for children's learning prior to activities in 10, 12 and 14.

10. Investigative and Evaluative Activities (IEAs)
- Discuss, investigate and, where practical, disassemble different examples of relevant battery-powered products, including those which are commercially available e.g. *Where and why they are used? How does the product work? What are its key features and components? How does the switch work? Is the product manually controlled or controlled by a computer? What materials have been used and why? How is it suited to its intended user and purpose?*
- Ask children to investigate examples of switches, including those which are commercially available, which work in different ways e.g. push-to-make, push-to-break, toggle switch. Let the children use them in simple circuits e.g. *How might different types of switches be useful in different types of products?*
- Remind children about the dangers of mains electricity.

11. Related learning in other subjects
- **Science** – know how to construct simple series circuits and have a basic understanding of conductors, insulators and open and closed switches.
- **Spoken language** – participate in discussion and evaluation of battery-powered products. Ask relevant questions to extend knowledge and understanding. Build their technical vocabulary.

12. Focused Tasks (FTs)
- Recap with the children how to make manually controlled, simple series circuits with batteries and different types of switches, bulbs and buzzers. Discuss which of the components in the circuit are input devices e.g. switches, and which are output devices e.g. bulbs and buzzers.
- Demonstrate how to find a fault in a simple circuit and correct it, giving pupils opportunities to practise.
- Use a simple computer control program with an interface box or standalone control box to physically control output devices e.g. bulbs and buzzers.
- Ask the children to make a variety of switches by using simple classroom materials e.g. card, corrugated plastic, aluminium foil, paper fasteners and paper clips. Encourage children to make switches that operate in different ways e.g. when you press them, when you turn them, when you push them from side to side. Ask the children to test their switches in a simple series circuit.
- Teach children how to avoid making short circuits.

13. Related learning in other subjects
- **Science** – know how to construct simple series circuits and have a basic understanding of conductors, insulators and open and closed switches.
- **Computing** – design, write and debug programs that accomplish specific goals, including controlling physical systems.
- **Spoken language** – asking questions to check understanding, develop technical vocabulary and build knowledge.

14. Design, Make and Evaluate Assignment (DMEA)
- Develop a design brief with the children within a context which is authentic and meaningful.
- Discuss with children the purpose of the battery-powered products that they will be designing and making and who they will be for. Ask the children to generate a range of ideas, encouraging realistic responses. Agree on design criteria that can be used to guide the development and evaluation of the children's products, including safety features.
- Using annotated sketches, cross-sectional and exploded diagrams, as appropriate, ask the children to develop, model and communicate their ideas.
- Ask the children to consider the main stages in making and testing before assembling high quality products, drawing on the knowledge, understanding and skills learnt through IEAs and FTs.
- Evaluate throughout and the final products against the intended purpose and with the intended user, drawing on the design criteria previously agreed.

15. Related learning in other subjects
- **Spoken language** – maintain attention and participate actively in collaborative conversations, staying on topic and initiating and responding to comments. Develop understanding through speculating, hypothesising, imagining and exploring ideas.
- **Science** – know how to construct simple series circuits and have a basic understanding of conductors, insulators and open and closed switches.
- **Computing** – design, write and debug programs that accomplish specific goals, including controlling physical systems.
- **Art and design** – using and developing drawing skills.

16. Possible resources
handling collection of battery-powered electrical products

switches including toggle, push-to-make and push-to-break

aluminium foil, paper fasteners, paper clips, card, corrugated plastic, reclaimed materials, finishing materials and media

buzzers, bulbs, bulb holders, zinc carbon or zinc chloride batteries batteries, battery holders, wire, automatic wire strippers

suitable control program with interface box or standalone control box

right/left handed scissors, PVA glue, cutting mats

17. Key vocabulary
series circuit, fault, connection, toggle switch, push-to-make switch, push-to-break switch, battery, battery holder, bulb, bulb holder, wire, insulator, conductor, crocodile clip

control, program, system, input device, output device

user, purpose, function, prototype, design criteria, innovative, appealing, design brief

18. Key competencies
problem-solving teamwork negotiation consumer awareness organisation motivation persuasion leadership perseverance other – specify

19. Health and safety
Pupils should be taught to work safely, using tools, equipment, materials, components and techniques appropriate to the task. Risk assessments should be carried out prior to undertaking this project.

20. Overall potential of project