1. Year Groups

Years 1/2

2. Aspect of D&T

Structures

Focus

Freestanding structures

3. Key learning in design and technology

Prior learning

- Experience of using construction kits to build walls, towers and frameworks.
- Experience of using of basic tools e.g. scissors or hole punches with construction materials e.g. plastic, card.
- Experience of different methods of joining card and paper.

Designing

- Generate ideas based on simple design criteria and their own experiences, explaining what they could make.
- Develop, model and communicate their ideas through talking, mock-ups and drawings.

Making

- Plan by suggesting what to do next.
- Select and use tools, skills and techniques, explaining their choices.
- Select new and reclaimed materials and construction kits to build their structures.
- Use simple finishing techniques suitable for the structure they are creating.

Evaluating

- Explore a range of existing freestanding structures in the school and local environment e.g. everyday products and buildings.
- Evaluate their product by discussing how well it works in relation to the purpose, the user and whether it meets the original design criteria.

Technical knowledge and understanding

- Know how to make freestanding structures stronger, stiffer and more stable.
- Know and use technical vocabulary relevant to the project.

4. What could children design, make and evaluate?

enclosures for farm or zoo animals

playground/park/garden furniture

bridge for Billy Goats Gruff playground equipment

furniture for the Three Bears other – specify

5. Intended users

themselves school community friends

children of different ages general public

older people story characters teddy animal

other – specify

6. Purpose of products

imaginary role-play pleasure

rest recreation health leisure

other – specify

7. Links to topics and themes

Traditional Tales Nursery Rhymes

Buildings Healthy living Farming

Our School Myself Animals

Parks and Playgrounds other - specify

8. Possible contexts

imaginary story-based classroom school

grounds gardens local community leisure

health 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)

- Go on a walk and/or look at photographs of the local area to explore structures such as playground equipment, street furniture, walls, towers and bridges e.g. *What are the structures called and what is their purpose? Who might use them? What materials have been used? Why have these been chosen? How have the parts been joined together? How have the structures been made strong enough? How have they been made stable?*
- Where possible, ask the children to draw or photograph the structures they have been exploring and label with the correct technical vocabulary in relation to the structure, materials used and shapes e.g. wall, tower, framework, base, joint, metal, wood, plastic, brick, triangle, square, rectangle, cuboid, cube.

11. Related learning in other subjects

- **Geography** – use simple fieldwork and observational skills to study the geography of their school and its grounds and the key physical features of its surrounding environment.
- **Spoken language** – participate in discussion about various structures, taking turns and listening to what others say. Ask relevant questions to extend their knowledge and understanding. Build technical vocabulary.

12. Focused Tasks (FTs)

- Demonstrate measuring, marking out, cutting, shaping, joining and finishing techniques with a range of tools and new and reclaimed materials that children are likely to use to make their structures. Discuss the suitability of materials for their products according to their characteristics.
- Ask the children to build and explore a variety of freestanding structures using construction kits, such as wooden blocks, interconnecting plastic bricks and those that make frameworks e.g. *How can you stop your structures from falling over? How they can be made stronger and stiffer in order to carry a load?* Children could make models of the structures they have seen in school and the local area.
- Ask children to fold paper or card in different ways to make freestanding structures, using masking tape where necessary to make joins. Encourage them to think about how folding materials can make them stronger, stiffer, stand up and be more stable e.g. *Can they support an object on top of their structures without it falling over or breaking?*

13. Related learning in other subjects

- **Mathematics** – use appropriate standard and non-standard measures. Recognise and name common 2-D and 3-D shapes.
- **Science** – think about the properties of materials that make them suitable or unsuitable for particular purposes.
- **Spoken language** – ask relevant questions to extend their knowledge and understanding. Build technical vocabulary.

14. Design, Make and Evaluate Assignment (DMEA)

- Discuss with the children what structure they will be designing, making and evaluating e.g. *Who will your product be for? What will be its purpose? What materials will you use? How will you make it strong and stable?*
- Generate some simple design criteria with the children e.g. the structure should stand up on its own, it should be strong enough to carry Teddy.
- Encourage the children to develop their ideas through talking, drawing and making mock-ups of their ideas with construction kits and other materials.
- As a whole class, plan the order in which the structures will be made. Children could make their final products from construction kits, new and reclaimed materials or any combination of these, according to their characteristics.
- Ask children to evaluate their developing ideas and final products against original design criteria.

15. Related learning in other subjects

- **Spoken language** – ask relevant questions to extend their knowledge and understanding. Build technical vocabulary. Use spoken language to develop understanding through imagining and exploring ideas.
- **Art and design** – use colour, pattern, line, shape. Use and develop drawing skills.
- **Science** – think about the properties of materials that make them suitable or unsuitable for particular purposes.

16. Possible resources

photographs of various structures

construction kits that can be used to construct freestanding structures e.g. walls, towers, frameworks

paper, card, plastic sheet, paper and plastic straws, pipe cleaners

reclaimed materials including small containers, card boxes, cotton reels

string, masking tape

PVA glue, Plasticine, left/right handed scissors, hole punch, stapler

finishing media and materials

17. Key vocabulary

cut, fold, join, fix

structure, wall, tower, framework, weak, strong, base, top, underneath, side, edge, surface, thinner, thicker, corner, point, straight, curved

metal, wood, plastic

circle, triangle, square, rectangle, cuboid, cube, cylinder

design, make, evaluate, user, purpose, ideas, design criteria, product, function

18. Key competencies

problem-solving teamwork negotiation

consumer awareness organisation motivation

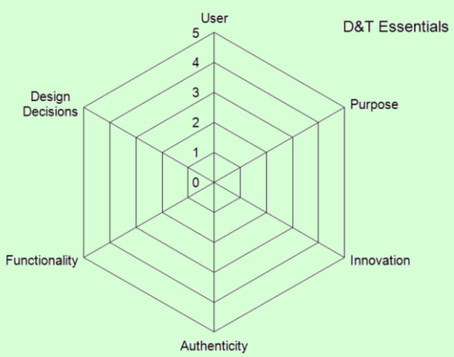
persuasion leadership perseverance

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 1/2

Structures
Freestanding structures

Instant CPD

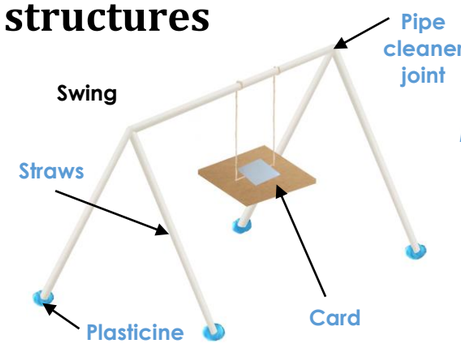
Tips for teachers

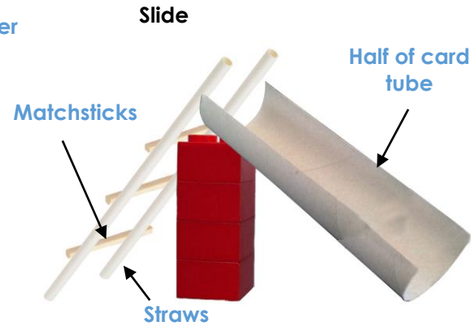
- ✓ Create a PowerPoint or range of pictures showing a variety of freestanding structures relevant to the product the children are designing and making.
- ✓ Exploring structures in the local area provides a good opportunity to develop children's observational drawing.
- ✓ Create and display a word bank of relevant technical vocabulary in the classroom.
- ✓ Ensure that work with construction kits and materials builds on children's prior experience in the Early Years Foundation Stage (EYFS).
- ✓ Ensure that different types of construction kits are available for children to explore through focused tasks.
- ✓ It is perfectly acceptable for children's final products to include both construction kits and consumable materials.
- ✓ Demonstrate measuring, marking out, cutting, joining and strengthening techniques and provide help sheets showing instructions for the children to practise independently.
- ✓ Prior to producing their designs, have a range of materials available for children to access and create models.

Useful resources at www.data.org.uk

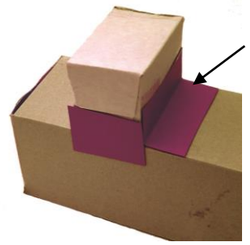
- Door hinges helpsheet
- Let's Get Building and Using Construction Kits Effectively
- Chairs for Three Bears
- Hinges and Catches
- Picture Frames and holders
- Working with Plastics
- Bird Hides Dragons' Den Challenge (Yrs 5-6)
- Working with paper straws (Yrs 3-4)

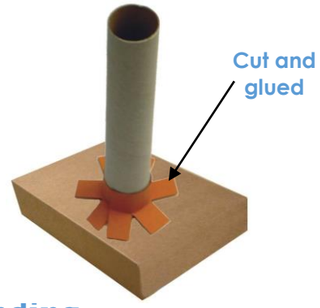
Techniques for assembling freestanding structures





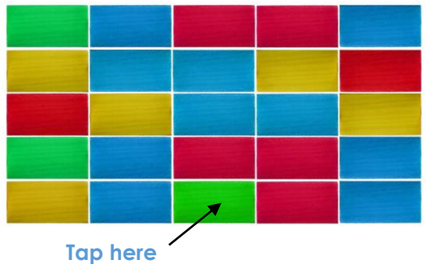
Show children how to join sheet materials and reclaimed boxes together using different tapes and glues.

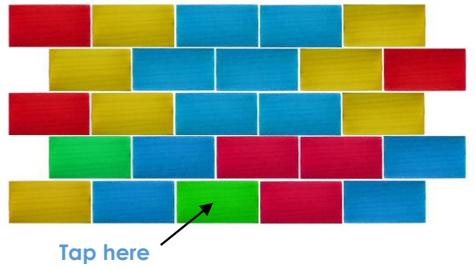


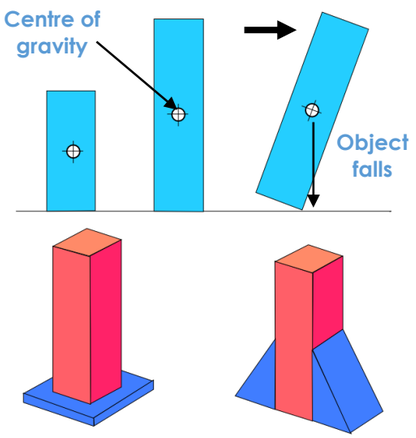


Technical knowledge and understanding

Build walls with these different patterns. Tap away the centre brick in the bottom row of each wall in turn. What happens? Which wall is the strongest?







As a freestanding structure becomes taller its centre of gravity rises. Stability in a structure can generally be increased by making the base wider, making the base heavier or adding buttresses.

Ask the children to build and explore a variety of freestanding structures through focused tasks. Use a range of construction kits.

Designing, making and evaluating a strong chair for Baby Bear

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 chair shall I make? Who is it for and what is it for?	Choose an appropriate soft toy Generating ideas through talking and drawing based on own experiences.
How can I make sure it is strong, stiff and stable?	Developing ideas using construction kits to create mock-ups.
Which joining techniques will work best for the chair?	Exploring and evaluating joining techniques.
What media, materials and kits will I use?	Exploring and evaluating construction kits, new and reclaimed materials.
What shall I do first? What tools and techniques will I use? What materials shall I use?	Selecting from a range of tools, techniques and materials Explaining choices.
More thoughts… judging, planning, generating new ideas.	More actions… making, testing, modifying.
Will the chair meet the needs of the user and achieve its purpose?	Evaluating the chair with a soft toy and against design criteria.

Glossary

- **Freestanding structure** – a structure that stands on its own foundation or base without attachment to anything else.
- **Frame structure** – a structure made from thin components e.g. tent frame.
- **Shell structure** – a hollow structure with a thin outer covering.
- **Stability** – in relation to a freestanding structure, the extent to which it is likely to fall over if a force is applied.
- **Buttress** – a structure added to a wall, tower or framework to make it more stable and/or reinforce it.
- **Brick bonding** – arranging bricks in a wall to improve the performance of the structure or improve its appearance.
- **Mock-up** – 3-D representation of a product.

1. Year Groups

Years 1/2

2. Aspect of D&T

Food

Focus

Preparing fruit and vegetables

3. Key learning in design and technology

Prior learning

- Experience of common fruit and vegetables, undertaking sensory activities i.e. appearance taste and smell.
- Experience of cutting soft fruit and vegetables using appropriate utensils.

Designing

- Design appealing products for a particular user based on simple design criteria.
- Generate initial ideas and design criteria through investigating a variety of fruit and vegetables.
- Communicate these ideas through talk and drawings.

Making

- Use simple utensils and equipment to e.g. peel, cut, slice, squeeze, grate and chop safely.
- Select from a range of fruit and vegetables according to their characteristics e.g. colour, texture and taste to create a chosen product.

Evaluating

- Taste and evaluate a range of fruit and vegetables to determine the intended user's preferences.
- Evaluate ideas and finished products against design criteria, including intended user and purpose.

Technical knowledge and understanding

- Understand where a range of fruit and vegetables come from e.g. farmed or grown at home.
- Understand and use basic principles of a healthy and varied diet to prepare dishes, including how fruit and vegetables are part of *The eatwell plate*.
- Know and use technical and sensory vocabulary relevant to the project.

4. What could children design, make and evaluate?

fruit salads fruit yogurt fruit drinks
fruit jelly fruit smoothies
vegetable salads fruit and vegetable kebabs
other – specify

5. Intended users

themselves parents siblings
grandparents friends peers at school
younger/older children visitors
other – specify

6. Purpose of products

picnic celebration party school event
sports day pleasure café corner
other – specify

7. Links to topics and themes

Healthy Eating Festivals and Celebrations
Teddy Bear Picnic Food and Farming
Ourselves Senses Growing
other – specify

8. Possible contexts

home school gardens playgrounds
local community culture industry
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 examine a range of fruit/vegetables. Use questions to develop children's understanding e.g. *What is this called? Who has eaten this fruit/vegetable before? Where is it grown? When can it be harvested? What are its taste, smell, texture and appearance? What will it look like if we peel it or cut it in half? What are the different parts called?*
- Provide opportunities for children to handle, smell and taste fruit and vegetables in order to describe them through talking and drawing. e.g. *What words can we use to describe the shape, colour, feel, taste?*
- Evaluate existing products to determine what the children like best; provide opportunities for the children to investigate preferences of their intended users/suitability for intended purposes e.g. *What do you prefer and why? What might we want to include in our product to meet our user's preferences? Which fruit/vegetables might be the best for our product to match the occasion/purpose?*

11. Related learning in other subjects

- **Science** – understand that plants have leaves, stems, roots, flowers and fruits; understand the importance of growing plants and how seasons affect growth.
- **Spoken language** – children develop and use a sensory vocabulary.
- **Writing** – develop descriptive writing based on first-hand experience of tasting fruit and vegetables.
- **Mathematics** – carry out a simple survey to find out which are the favourite fruits/vegetables; construct and interpret the information in e.g. pictograms and bar graphs.

12. Focused Tasks (FTs)

- 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?*
- Demonstrate how to use simple utensils and provide opportunities for the children to practise food-processing skills such as washing, grating, peeling, slicing, squeezing e.g. *Do we eat the whole fruit? Why or why not? Which parts do we eat? What might we have to do before eating this? Why do we cut, grate, peel and slice in this way?* Discuss different effects achieved by different processes.
- Discuss healthy eating advice, including eating more fruit and vegetables; using *The eatwell plate* model talk about the importance of fruit and vegetables in our balanced diet e.g. *Why is it good to eat fruit and vegetables? How many pieces of fruit/vegetables do you eat per day? Why is it important to wash fruit/vegetables before we eat them?*

13. Related learning in other subjects

- **Spoken language** – ask questions to check understanding; use the correct terminology for equipment and food processes.
- **Writing** – instructions on how to use one of the utensils; how to prepare e.g. a fruit for eating.
- **Science** – talk about a balanced diet, different types of food and hygiene.

14. Design, Make and Evaluate Assignment (DMEA)

- Set a context for designing and making which is authentic and meaningful.
- Discuss with the children the possible products that they might want to design, make and evaluate and who the products will be for. Agree on design criteria that can be used to guide the development and evaluation of children's products e.g. *Who/what is the product for? What will make our product unique/different? How will we know that we designed and made a successful product?*
- Use talk and drawings when planning for a product; ask the children to develop, model and communicate their ideas e.g. *What will you need? What fruit/vegetable will you need? How much will you need? How will you present the product?*
- Talk to the children about the main stages in making, considering appropriate utensils and food processes they learnt about through IEAs and FTs.
- Evaluate as the children work through the project 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** – ask questions to develop and check understanding, develop technical and sensory vocabulary and build knowledge.
- **Art and design** – use and develop drawing skills.
- **Writing** – children write a simple account about how they made their food product.
- **Computing** – use digital photographs to help order the main stages of making and support children's writing.

16. Possible resources

range of fresh fruit and vegetables

chopping boards, knives, peelers, graters, skewers, juicers, spoons, jugs, plates, bowls, aprons, plastic table covers, hand washing and washing-up facilities

yogurt making machine or blender, if appropriate

17. Key vocabulary

fruit and vegetable names, names of equipment and utensils

sensory vocabulary e.g. soft, juicy, crunchy, sweet, sticky, smooth, sharp, crisp, sour, hard

flesh, skin, seed, pip, core, slicing, peeling, cutting, squeezing, healthy diet, choosing, ingredients, planning, investigating tasting, arranging, popular, design, evaluate, criteria

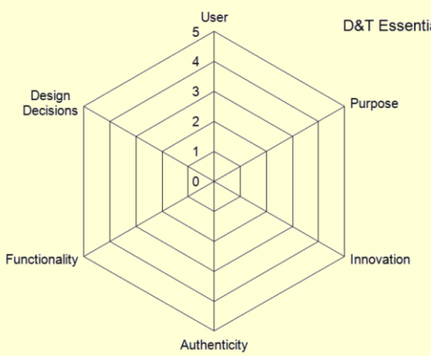
18. Key competencies

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 1/2

Food

Preparing fruit and vegetables

Instant CPD


Tips for teachers

- ✓ Display fruit, including photographs and associated technical vocabulary, to encourage the children to use it when discussing, designing and making a food product.
- ✓ Ask the children to sort a selection of fruit and vegetables – which is which? Photo cards could be used for this.
- ✓ Include fruit that is less likely to be known to the children.
- ✓ Stories and poems about food could be used for inspiration and as an introduction to the project.
- ✓ Visit a local shop or food market to give your project a real-life context.
- ✓ Carrots can provide a relatively cheap food for examining the effects of using different equipment such as grating, slicing into thin rings, slicing into sticks.
- ✓ Serrated knives with rounded ends are the best.
- ✓ Foods for chopping/slicing could be cut in half lengthways to provide a flat base and held still with, for example, a fork so that children cut safely.
- ✓ Before you organise any food tasting in your class, you need to check your school and local authority health and safety policy. Seek parental consent.
- ✓ As homework ask children to keep a weekly fruit and vegetable diary and ask them to record their results in a chart/table. If more appropriate, focus on fruit and vegetables served in school.

Useful resources at www.data.org.uk

- **Caribbean fruit cocktails** (7-9 years but contains useful information)
- **Are you teaching food in Primary D&T?**
- **Super salads** (7-9 years but contains useful information)
- **Chilled Food Association resources**
- **Fantastic fruit**

Other useful web-based resources:

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

Teaching aids to demonstrate food processing skills

Peeling

Cutting

Slicing

Grating

Squeezing

Food Processing Equipment

Utensil	Food	Effect	Mouth feel
Juicer 	Orange	Makes juice	Liquid
Peeler 	Apple	Unpeeled apple	Crunchy
Knife 	Carrot	Thin rings	Crispy hard

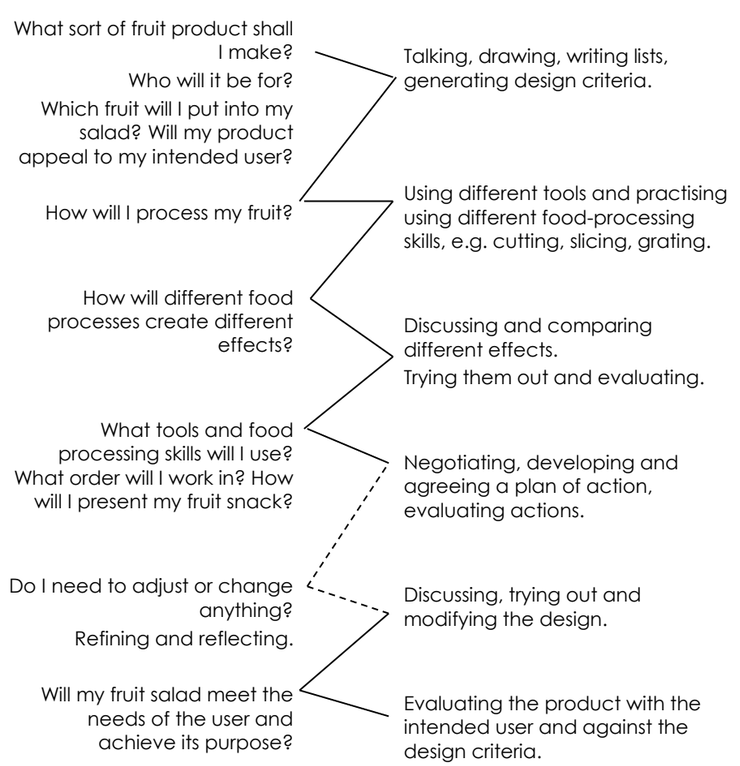
Hygiene – some key pointers

- Jewellery is removed
- Hair is tied back
- Sleeves are rolled up
- Aprons are on
- Hands are washed
- Cuts are covered with blue waterproof dressing

Further information from www.foodafactoflife.org.uk

Designing, making and evaluating a fruit snack for a class picnic

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

- **Fruit** – plant or tree's edible seed with envelope.
- **Vegetable** – plant used for food.
- **Nutrients** – all the things in food that the body needs to remain healthy.
- **Pith** – the soft white lining inside fruit such as oranges.
- **Salad** – a cold dish of fresh and/or cooked vegetables or fruit.
- **Sensory evaluation** – subjective testing of foods where senses are used to evaluate qualities such as appearance, smell, taste, texture (mouth feel).
- **Kebab** – cooked and/or fresh ingredients on a skewer.

1. Year Groups

Years 1/2

2. Aspect of D&T

Textiles

Focus

Templates and joining techniques

3. Key learning in design and technology

Prior learning

- Explored and used different fabrics.
- Cut and joined fabrics with simple techniques.
- Thought about the user and purpose of products.

Designing

- Design a functional and appealing product for a chosen user and purpose based on simple design criteria.
- Generate, develop, model and communicate their ideas as appropriate through talking, drawing, templates, mock-ups and information and communication technology.

Making

- Select from and use a range of tools and equipment to perform practical tasks such as marking out, cutting, joining and finishing.
- Select from and use textiles according to their characteristics.

Evaluating

- Explore and evaluate a range of existing textile products relevant to the project being undertaken.
- Evaluate their ideas throughout and their final products against original design criteria.

Technical knowledge and understanding

- Understand how simple 3-D textile products are made, using a template to create two identical shapes.
- Understand how to join fabrics using different techniques e.g. running stitch, glue, over stitch, stapling.
- Explore different finishing techniques e.g. using painting, fabric crayons, stitching, sequins, buttons and ribbons.
- Know and use technical vocabulary relevant to the project.

4. What could children design, make and evaluate?

glove puppet finger puppet simple bag

clothes for teddy/soft toy/class doll

fabric placemat other – specify

5. Intended users

themselves friends younger children

parents grandparents teddy story character

class doll soft toy other – specify

6. Purpose of products

plays with puppets clothes for toys

carrying and storing items protecting surfaces

imaginary role-play other – specify

7. Links to topics and themes

Toys Festivals Stories Nursery Rhymes

Celebrations Homes other – specify

8. Possible contexts

entertainment leisure home school

recycling/reusing 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 evaluate existing products linked to the chosen project. Explore and compare e.g. fabrics, joining techniques, finishing techniques and fastenings used.
- Use questions to develop children's understanding e.g. *How many parts is it made from? What is it joined with? How is it finished? Why do you think these joining techniques have been chosen? How is it fastened? Who might use it and why?*
- Make drawings of existing products, stating the user and purpose. Identify and label, if appropriate, the fabrics, fastenings and techniques used.

11. Related learning in other subjects

- **Spoken language** – ask relevant questions to build understanding and their vocabulary.
- **Art and design** – quick drawings or detailed observational drawings of one product to develop and share ideas.

12. Focused Tasks (FTs)

- Investigate fabrics to determine which is best for the purpose of the product they are creating.
- Using prepared teaching aids, demonstrate the use of a template or simple paper pattern. Children could make their own templates or paper patterns. If necessary, they can use ones provided by the teacher.
- Using prepared teaching aids, demonstrate the correct use of appropriate tools to mark out, tape or pin the fabric to the templates or paper patterns and cut out the relevant fabric pieces for the product.
- Using prepared teaching aids, demonstrate appropriate examples of joining techniques for children to practise in guided groups e.g. running stitch including threading own needle, stapling, lacing and gluing. Talk about the advantages and disadvantages of each technique.
- Using prepared teaching aids, demonstrate examples of finishing techniques for children to practise in guided groups e.g. sewing buttons, 3-D fabric paint, gluing sequins, printing.

13. Related learning in other subjects

- **Science** – everyday materials. Investigate physical properties of fabric types against suitability for the product to be made.
- **Spoken language** – ask questions throughout the process to check understanding, develop vocabulary and build knowledge. Listen and respond to adults.
- **Art and design** – use colour, pattern, texture, and shape as appropriate.

14. Design, Make and Evaluate Assignment (DMEA)

- Provide the children with a context that is authentic. Discuss with children the purpose and user of the products they will be designing, making and evaluating. Design criteria developed with the teacher should be used to guide the development and evaluation of the children's products.
- Ask the children to generate a range of ideas e.g. *What parts will the product need to have and what will it be made from? What size will it be? How will it be joined and finished?*
- Through talk, drawings and mock-ups, ask the children to develop and communicate their ideas. Information and communication technology could be used for symmetry and pattern ideas. Choose one idea to follow through.
- Talk with the children about the stages in making before assembling quality products, applying the knowledge, understanding and skills learnt through the IEAs and FTs.
- Evaluate ongoing work 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

- **Science** – use knowledge of properties of everyday materials to select appropriate ones for their products.
- **Spoken language** – ask questions throughout the process to check understanding, develop vocabulary and build knowledge. Explain and articulate their ideas orally.
- **Art and design** – use and develop drawing skills.
- **Mathematics** – measurement using non-standard and standard units.
- **Computing** – use technology purposefully to create and manipulate digital content.

16. Possible resources

existing products linked to chosen project

variety of textiles e.g. dipryl, felt, reclaimed fabric

thread, pins, needles, magnet, staplers, staples, fabric glue

left/right handed scissors

items for finishing e.g. buttons, wool, fabric paints, sequins

drawing and colouring media

17. Key vocabulary

names of existing products, joining and finishing techniques, tools, fabrics and components

template, pattern pieces, mark out, join, decorate, finish

features, suitable, quality mock-up, design brief, design criteria, make, evaluate, user, purpose, function

18. Key competencies

problem-solving teamwork negotiation

consumer awareness organisation motivation

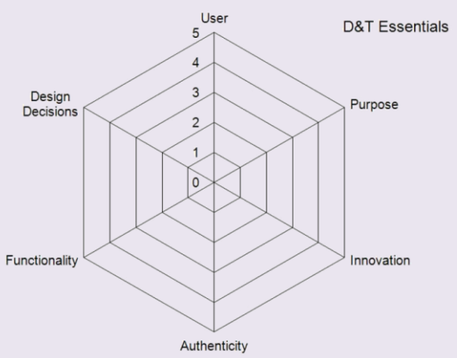
persuasion leadership perseverance

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 1/2

Textiles
Templates and joining

Instant CPD



Tips for teachers

- ✓ It is helpful if each child has a named plastic envelope, zip wallet or folder in which to keep their work safe.
- ✓ Give children the opportunity to join fabrics in a variety of ways through focused tasks and compare the outcomes.
- ✓ In order for children to thread their own needle start by using a needle with a large eye and a sharp point.
- ✓ Children's stitching skills may be in their infancy and fabrics need to be chosen with this in mind. Start with felt as it doesn't fray and progress to other fabrics.
- ✓ Fabrics used for children's products could be reclaimed.
- ✓ Children should be taught to place their templates and pattern pieces economically on the fabric.
- ✓ Children could be reminded of sustainability issues, and of the need to reduce, reuse and recycle.
- ✓ Demonstrate sewing techniques, joining two pieces of fabric e.g. running stitch.
- ✓ Demonstrate other ways of joining, not sewing, to the class e.g. sticking, stapling, lacing.
- ✓ Encourage the children to make a mock-up from dipryl (disposable cloth fabric).
- ✓ Put technical vocabulary onto flash cards.

Useful resources at www.data.org.uk

- Teddy's Safety Jacket
- Joining and Fastening Fabrics
- Special Sun Hat for Barnaby Bear
- Designing with textiles (7-11 years)

EYFS Resources

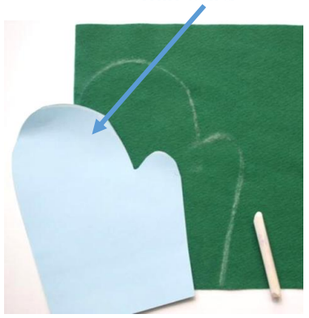
- Three Bears Picnic Blanket
- Let's Look at Hats

Three alternative ways of using templates and simple pattern pieces

Thin card

Use clear sticky tape to position pattern on fabric. Cut around the pattern.

Thin card



Use soft chalk pastel or soft white crayon to draw around the pattern prior to cutting out.

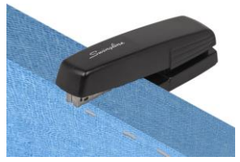
Paper

Use pins to secure the pattern on the fabric. Cut around the pattern.

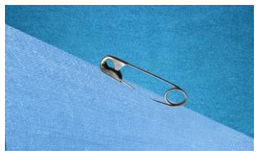
Exploring and evaluating joining techniques

Joining fabric

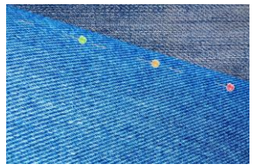
Gluing



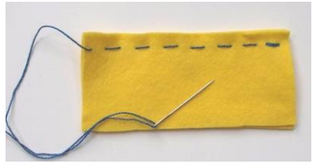
Stapling



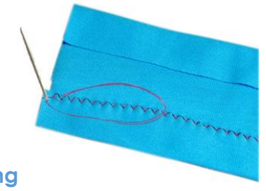
Safety pin



Pinning



Sewing



Finishing techniques

Textile paints – glitter

Adding sequins and shiny fabrics

Textile paints – raised

Fabric crayons

Explore different techniques, including information and communication technology, for creating fabric designs and finishing techniques.

Designing, making and evaluating a puppet to perform a play

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 puppet shall I make? Who is it for and what is it for?	Generating ideas through talking and drawing based on own experiences.
How can I make sure it fits my hand or finger?	Developing ideas using templates or pattern pieces to create mock-ups.
Which joining technique will work best for my puppet?	Exploring and evaluating joining techniques.
What media and materials will I use? How will I add the features?	Exploring and evaluating media and materials.
What shall I do first? What tools and techniques will I use? What fabrics shall I use?	Selecting from a range of tools, techniques and materials. Explaining choices.
More thoughts… judging, planning, generating new ideas.	More actions… making, testing, modifying.
Will the puppet meet the needs of the user and achieve its purpose?	Evaluating the puppet with the intended user and against original design criteria.

Glossary

- **Appliqué** – to attach a decorative fabric item onto another piece of fabric by gluing and/or sewing.
- **Design** – to generate, develop and communicate ideas for a product.
- **Embroider** – to decorate fabric with stitches.
- **Evaluate** – to judge how a product meets chosen criteria.
- **Fray** – to unravel or become worn at the edge.
- **Glove puppet** – a glove puppet fits over the hand, and the fingers operate its head and arms.
- **Mock-up** – a model which allows children to try out ideas using cheaper materials and temporary joints.
- **Seam** – a row of stitches joining two pieces of fabric.
- **Sew** – to join pieces of fabric with stitches.
- **Template** – a shape drawn to assist in cutting out shapes.

1. Year Groups

Year 1/2

2. Aspect of D&T

Mechanisms

Focus

Wheels and axles

3. Key learning in design and technology

Prior learning

- Assembled vehicles with moving wheels using construction kits.
- Explored moving vehicles through play.
- Gained some experience of designing, making and evaluating products for a specified user and purpose.
- Developed some cutting, joining and finishing skills with card.

Designing

- Generate initial ideas and simple design criteria through talking and using own experiences.
- Develop and communicate ideas through drawings and mock-ups.

Making

- Select from and use a range of tools and equipment to perform practical tasks such as cutting and joining to allow movement and finishing.
- Select from and use a range of materials and components such as paper, card, plastic and wood according to their characteristics.

Evaluating

- Explore and evaluate a range of products with wheels and axles.
- Evaluate their ideas throughout and their products against original criteria.

Technical knowledge and understanding

- Explore and use wheels, axles and axle holders.
- Distinguish between fixed and freely moving axles.
- Know and use technical vocabulary relevant to the project.

4. What could children design, make and evaluate?

push/pull toys e.g. emergency service vehicle
carnival float farm vehicle clown's car
vehicle for imaginary/story character
shopping trolley other – specify

5. Intended users

themselves people who help us friends
story character farmers/farm animals
teddy class doll other – specify

6. Purpose of products

making work or everyday life easier
moving objects toy vehicle to play with
solving a problem for a story character
other – specify

7. Links to topics/themes

People Who Help Us Helping Others
Our Local Community Food and Farming
Traditional Stories Fairy Tales Transport
Nursery Rhymes Toys other – specify

8. Possible contexts

imaginary story-based home school
leisure culture 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)

- Explore and evaluate a range of wheeled products such as toys and everyday objects. Through questioning, direct children's observations e.g. the number, size, position and methods of fixing wheels and axles. *How do you think the wheels move? How do you think the wheels are fixed on? Why do you think the product has this number of wheels? Why do you think the wheels are round?*
- Draw an example of a wheeled product, stating the user and purpose, and labelling the main parts e.g. body, chassis, wheels, axles and axle holders.
- Walk around the school building and grounds, recording how wheels and axles are used in daily life.
- Read a story or non-fiction book that includes a wheeled product. Use this to introduce relevant vocabulary and to emphasise user and purpose.

11. Related learning in other subjects

- **Science** – working scientifically: ask simple questions and observe closely. Explore use of everyday materials.
- **Mathematics** – number of wheels, more than, less than, equal.
- **Spoken Language** – use of technical vocabulary. Ask relevant questions to extend understanding and build vocabulary and knowledge.

12. Focused Tasks (FTs)

- Using construction kits with wheels and axles, ask children to make a product that moves.
- Demonstrate to children how wheels and axles may be assembled as either fixed axles or free axles.
- Show different ways of making axle holders and stress the importance of making sure the axles run freely within the holders.
- Ensure that children are taught how to mark out, hold, cut and join materials and components correctly.
- Using samples of materials and components they will use when designing and making, ask the children to assemble some examples of wheel, axle, axle holder combinations. Display the work completed as a reference for their DMEA.

13. Related learning in other subjects

- **Spoken language** – give well-structured descriptions and explanations. Develop speaking and listening skills. Learn relevant technical vocabulary.
- **Mathematics** – measuring length using non-standard and standard units.

14. Design, Make and Evaluate Assignment (DMEA)

- Discuss with the children what they will be designing, making and evaluating within an authentic context.
- With the children identify a user and purpose for the product and generate simple criteria.
- Ask children to generate, develop and communicate their ideas as appropriate e.g. through talk and drawing. Talk about, evaluate and share ideas with other children/adults.
- Make their wheel and axle product using their design ideas and criteria as an ongoing guide.
- Discuss how the children might add finishing techniques to their product with reference to their design ideas and criteria. Direct the children to information and communication technology opportunities such as clip art, word processing, paint or simple drawing programs.
- Ask children to evaluate their finished product, communicating how it works and how it matches their design criteria, including any changes they made.

15. Related learning in other subjects

- **Spoken language** – use spoken language to develop understanding through imagining and exploring ideas.
- **Art and Design** – use a range of media and materials creatively to design and make products.
- **Computing** – use technology purposefully to create and manipulate digital content.
- **Mathematics** – measurement using non-standard and standard units.

16. Possible resources

selection of toy vehicles with differently fixed axles

card boxes, card, cotton reels, plastic tubing, dowel, clothes pegs, paper sticks/dowel, paper/plastic straws, card discs, MDF wheels, wooden wheels

single hole punch, card drill, cutting mat, masking tape, PVA glue, paint, thin/thick paint brushes, felt tip pens, decorative paper, double sided sticky fixers, junior hacksaw, vice, left/right handed scissors

17. Key vocabulary

vehicle, wheel, axle, axle holder, chassis, body, cab

assembling, cutting, joining, shaping, finishing, fixed, free, moving, mechanism

names of tools, equipment and materials used

design, make, evaluate, purpose, user, criteria, functional

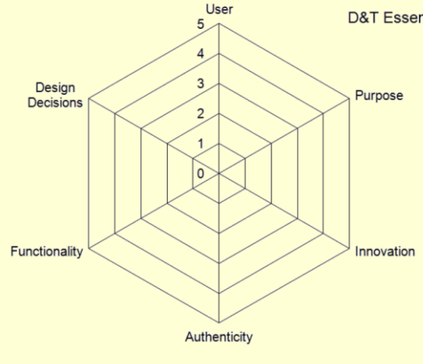
18. Key competencies

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



Years 1/2

Mechanisms
Wheels and axles

Instant CPD

Tips for teachers

- ✓ Ensure a variety of different shaped boxes are available so children can select the one most appropriate for their design.
- ✓ Provide wheels with a range of diameters and thicknesses for children to explore and select the most suitable.
- ✓ A card disc glued onto a wooden/MDF wheel is easy to draw on to add details using felt tip pens.
- ✓ To add a trailer, use flat magnets glued onto the ends of boxes (opposite poles outwards) or short pieces of pipe cleaner bent to form a 'hook and eye'.
- ✓ **Homework** – ask children to complete a checklist of different types of vehicles and how many of each one they see in their local area.
- ✓ **Homework** – ask the children to record a range of wheeled toys. They could record in writing or with pictures such as drawings, cut outs or photographs.

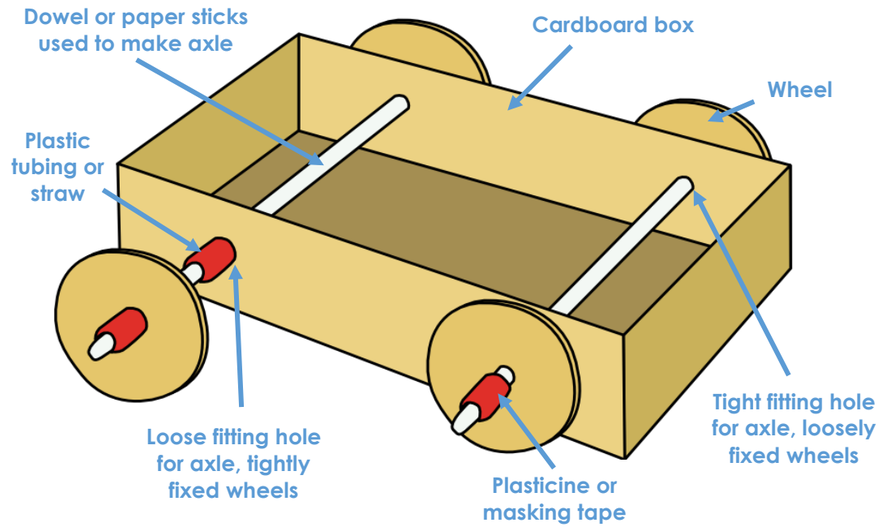
Useful resources at www.data.org.uk

- **Working with wheels and axles** (9-11 years but contains useful information)

EYFS Resources

- **Let's Look at Vehicles** PowerPoints with a range of wheels with discussion prompts and 'design a vehicle for an alien' activity and lesson planning.
- **Toys** Activities and goals for teaching about toys, including building a toy collection and practical skills.
- **D&T Primary issue 34** Innovations in wheel design. Years 4-6.

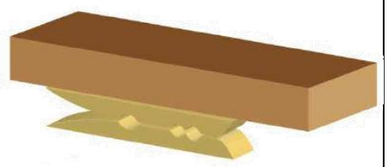
Two different ways to fix wheels



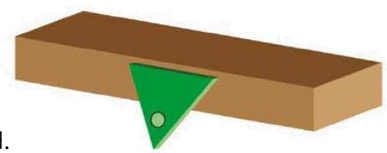
Types of wheels

Ways to hold moving axles

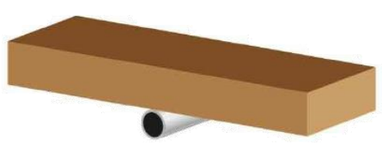
Use **pairs of clothes pegs** glued with PVA to the underside of a box.
Check the peg holes are large enough to allow axles to move freely.
Make sure they are aligned carefully so the vehicle moves in a straight line when the wheel and axle mechanism is added.



Use **card triangles** with holes for the axle.
Check the holes are large enough to allow the axle to move freely.
Make sure opposite triangles are aligned carefully so the vehicle moves in a straight line when the wheel and axle mechanism is added.



Use **large paper/plastic straws** fixed with masking tape to the underside of a box.
Check straws are positioned carefully so the vehicle will move in a straight line when the wheel and axle mechanisms are added.
Make sure the straw hole is large enough to allow the axle to move freely. The wheels must be fixed tightly to the axle.



Designing, making and evaluating a small wheeled trolley that will carry tools to use in the school garden or for a character in a story

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 trolley for?	Talk about and explore a range of existing wheeled products.
How many wheels will it need? What type of wheels will be best? What does it need to carry?	Discuss and consider the best size and material from the wheels available. Talk about the surfaces the trolley might have to travel over.
	Discuss and list the things that need to be carried.
Should there be sections for different items? How big does each section need to be?	Use drawings and collect different sized and shaped boxes. Clarify and model ideas using the boxes.
Do we want to pull or push it? Which way moves best?	Try out existing trolleys and test out ideas including different types of handles.
How could it be appealing as well as functional?	Talk about and combine ideas to create designs.
What tools, resources and materials will we need?	Think about and collect resources Select appropriate tools.
What will I do if something does not work as planned?	Reflect on and refine ideas and designs as the process develops.
How will I check the trolley is fit for the user and for its purpose as I make it?	Frequently test the movement and design of the trolley with and without contents.
What do I think about my final product.	Reflect and evaluate against the original design criteria.

Glossary

- **Axle** – a rod on which one or more wheels can rotate, either freely or be fixed to and turn with the axle.
- **Axle holder** – the component through which an axle fits and rotates.
- **Chassis** – the frame or base on which a vehicle is built.
- **Friction** – resistance which is encountered when two things rub together.
- **Dowel** – wooden rods used for making axles to hold wheels.

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.

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.

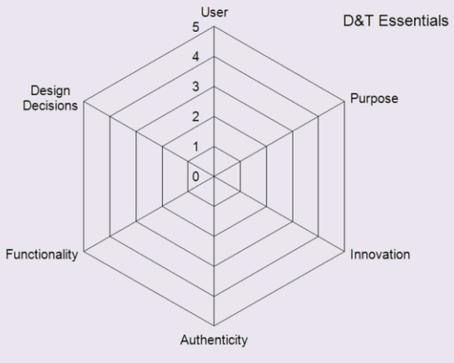
14. Design, Make and Evaluate Assignment (DMEA)

- 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.

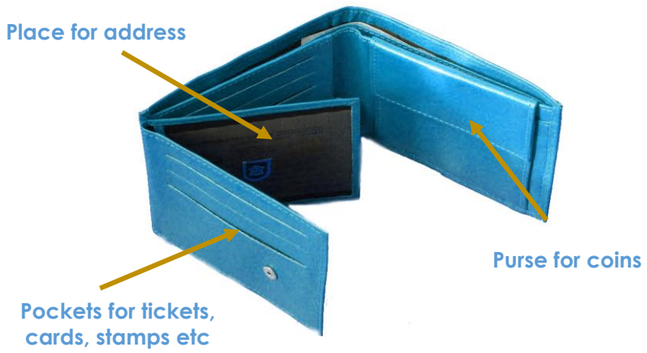
20. Overall potential of project



Years 3/4

Textiles
2-D shape to 3-D product

Instant CPD



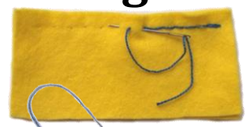
Tips for teachers

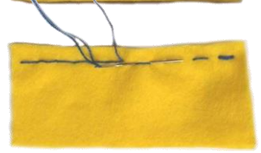
- ✓ Have simple patterns available for children who may find it difficult to create their own.
- ✓ Demonstrate stitching techniques and have help sheets showing stitch instructions for the children to practise independently.
- ✓ Complete sewing practice in small groups. Use adult helpers to provide additional 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

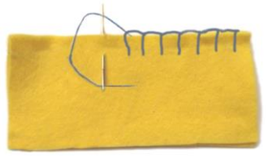
- Aprons
- Fancy a bag?
- Designing with textiles
- Bendy bags (Years 1/2)
- A to Z of D&T
- Working with Materials

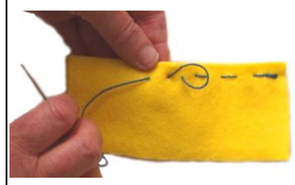
Teaching aids – joining techniques


Back stitch


Backwards running stitch

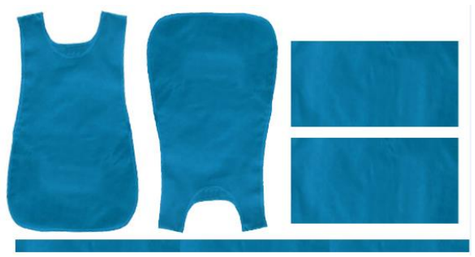

Over sew stitch


Blanket stitch


Running stitch

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.

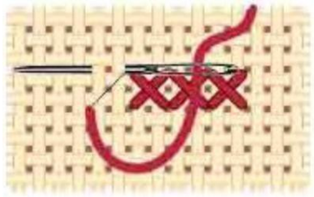

Bonded

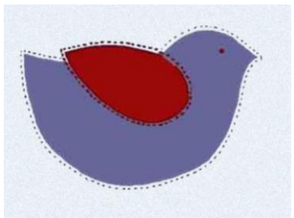

Woven


Knitted


Felted

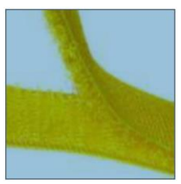
Decorative Techniques


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 fulfill 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

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

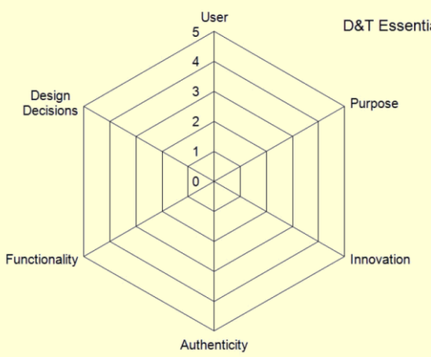
18. Key competencies

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 3/4

2. Aspect of D&T

Mechanical systems

Focus

Levers and linkages

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.

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.

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.

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.

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

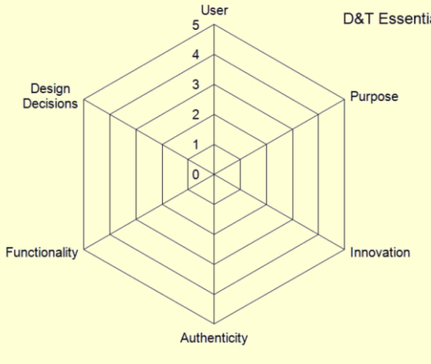
18. Key competencies

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.

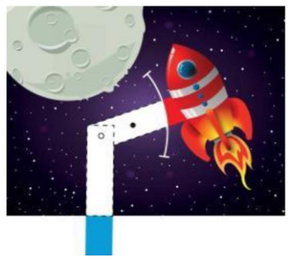
20. Overall potential of project



Years 3/4

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.

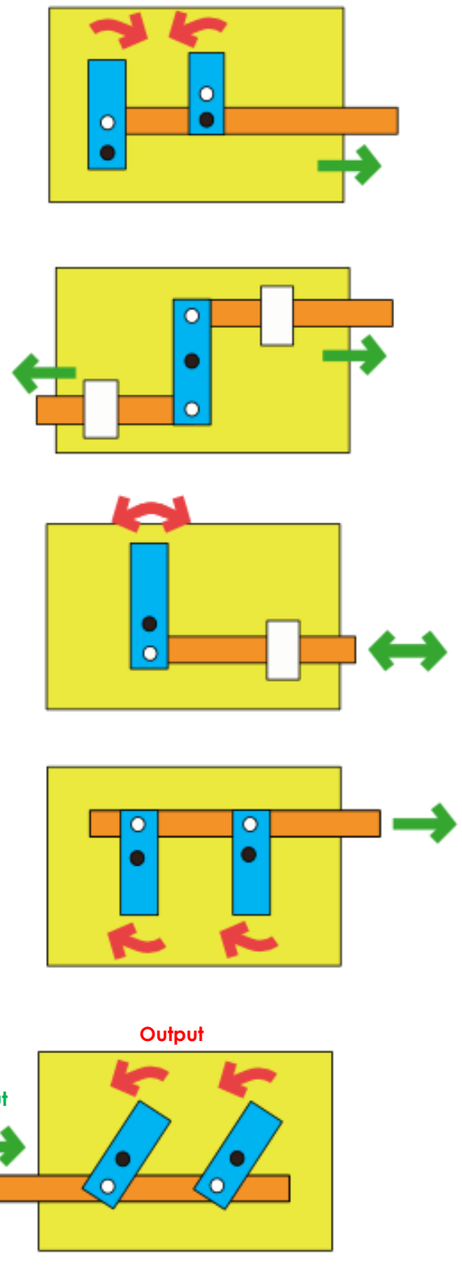
Useful resources at www.data.org.uk

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

Teaching aids to demonstrate levers and linkages

Fixed pivot

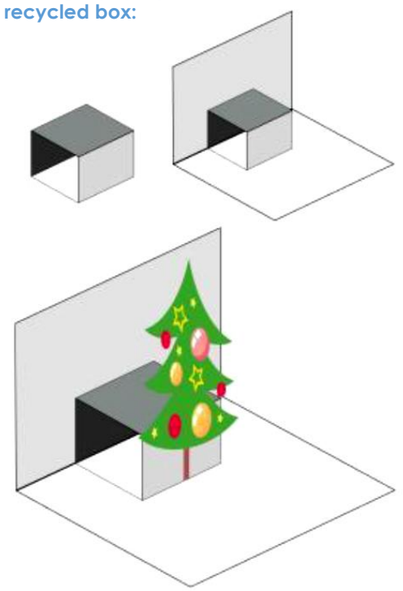
Loose pivot



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 trialling 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.

1. Year Groups

Years 3/4

2. Aspect of D&T

Mechanical systems

Focus

Pneumatics

3. Key learning in design and technology

Prior learning

- Explored simple mechanisms, such as sliders and levers, and simple structures.
- Learnt how materials can be joined to allow movement.
- Joined and combined materials using simple tools and techniques.

Designing

- Generate realistic and appropriate 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 and join materials and components such as tubing, syringes and balloons.
- Select from and use finishing techniques suitable for the product they are creating.

Evaluating

- Investigate and analyse books, videos and products with pneumatic mechanisms.
- Evaluate their own products and ideas against criteria and user needs, as they design and make.

Technical knowledge and understanding

- Understand and use pneumatic mechanisms.
- Know and use technical vocabulary relevant to the project.

4. What could children design, make and evaluate?

tipper truck jack-in-the-box class display
moving creature shop window display
moving toy other – specify

5. Intended users

themselves peers younger children
older children shoppers visitor to school
other – specify

6. Purpose of products

celebration event information educational
play advertising interests and hobbies
campaign other – specify

7. Links to topics/themes

Toys and Games Our Community
Forces and Movement Mini-enterprise
other – specify

8. Possible contexts

shop 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.

10. Investigative and Evaluative Activities (IEAs)

- Children investigate, analyse and evaluate familiar objects that use air to make them work e.g. bicycle pump, balloon, inflatable swimming aids, foot pump for inflating an air bed. *What does the air do? How has it been used in the design of these products? How can air be used to move heavy objects?*
- Construct a simple pneumatic system by joining a balloon to 5mm tubing and then to a washing-up liquid bottle. *What happens to the air when you squeeze the bottle? What happens when you let go? Can you lift a soft toy or a note pad using a balloon?*
- Demonstrate lifting an object and ask the children to think about ways in which this might be used in a product. *Who might it be for? What is its purpose? What part moved and how did it move? What materials have been used? How effective do you think it is and why? What else could move?*
- Demonstrate a range of pneumatic mechanisms using prepared teaching aids including two syringes joined by plastic tubing; three syringes connected using a T-connector and using different sized syringes. Ask the children: *What happens when the plunger of one syringe is pressed in? Why do the syringes move at different speeds?* Note: take care as the syringe may come out with force. Discuss why, when pressing a large syringe, it can take time and feel 'squishy' before the smaller syringe is moved.

11. Related learning in other subjects

- **Spoken language** – participate in discussion and evaluation of examples of products that use pneumatics. Ask relevant questions to extend knowledge and understanding. Build technical vocabulary.
- **Science** – identify and compare the suitability of a variety of everyday materials for particular uses.

12. Focused Tasks (FTs)

- Demonstrate how to assemble the systems using syringes, tubing, balloons and plastic bottles. Introduce ways in which pneumatic systems can be used to operate levers.
- Demonstrate the correct and accurate use of measuring, marking out, cutting, joining and finishing skills and techniques.
- Provide the materials and ask the children to try out and draw the three systems they have been shown: a) Balloon connected to a washing-up liquid bottle. *What happens when you squeeze the bottle? What happens when you let go?* b) Two syringes of the same size connected together. *What happens when you press the plunger of one syringe down? How far does the other syringe move?* c) Two syringes of different sizes connected together. *How far do these syringes move when pressed?*

  Note: take care as the syringe may come out with force.

13. Related learning in other subjects

- **Spoken language** – ask relevant questions to extend knowledge and understanding.
- **Mathematics** – measure, compare, add and subtract: lengths, volume and capacity.

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, 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. Consider and evaluate different viewpoints.
- **Art and design** – use and develop drawing techniques. Use colour, pattern, line, shape.
- **Science** – when evaluating, make systematic and careful observations and take accurate measurements.

16. Possible resources

examples of products and books, photos and videos showing pneumatic systems

washing-up liquid bottles, 5mm plastic tubing, sterile syringes, T-connectors, balloons

card, plastic sheet, PVA glue, masking tape, parcel tape, sticky pads, pipe cleaners, elastic bands, syringe clips,

left/right handed scissors, snips, card drills, cutting mats, hole punches, finishing media and materials

17. Key vocabulary

components, fixing, attaching, tubing, syringe, plunger, split pin, paper fastener

pneumatic system, input movement, process, output movement, control, compression, pressure, inflate, deflate, pump, seal, air-tight

linear, rotary, oscillating, reciprocating

user, purpose, function, prototype, design criteria, innovative, appealing, design brief, research, evaluate, ideas, constraints, investigate

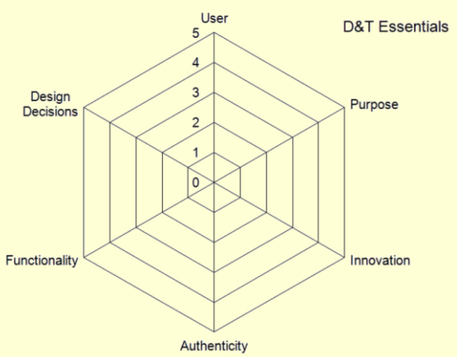
18. Key competencies

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

Mechanisms
Pneumatics

Instant CPD

Tips for teachers

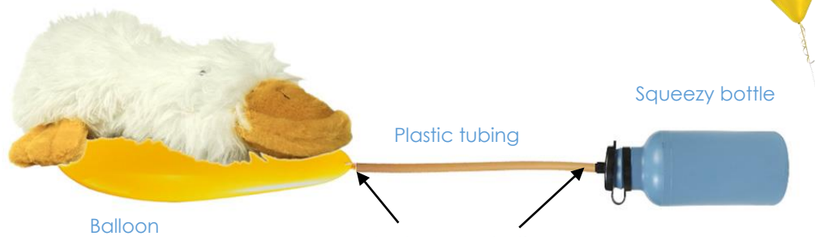
- ✓ Card from recycled packaging is a cost-efficient way of providing enough material for children to experiment with different arrangements and to make mock-ups and prototypes.
- ✓ To help develop children's technical knowledge, research images and videos of pneumatics in action, including Lego models and hydraulic systems used in construction machines.
- ✓ Tell the children that while air can be compressed, liquids cannot, which is why the syringe can feel squishy with a pneumatic system.
- ✓ Do not use syringes unless they are supplied in a sealed package.
- ✓ Take care – a large syringe can push out a small syringe with great force.
- ✓ Build up a collection of washing-up liquid bottles, egg boxes and other boxes well before starting the project. Make sure they are empty and properly cleaned before using them.
- ✓ Takeaway shops may give away a few clean food containers which can be covered in papier-mâché and painted.
- ✓ Get the children to blow air on their hands and feel the flow of air.
- ✓ Use a cycle pump to try to knock over a card structure, and then repeat using the air from a stronger pump or balloon.
- ✓ Balloons need to be securely fixed to the tubing. Use a tight elastic band wound several times or use masking tape.
- ✓ Display technical vocabulary and encourage the children to use it when discussing mechanisms and when designing and making.
- ✓ To ensure safety and hygiene, balloons should not be blown up by mouth.

Useful resources at www.data.org.uk

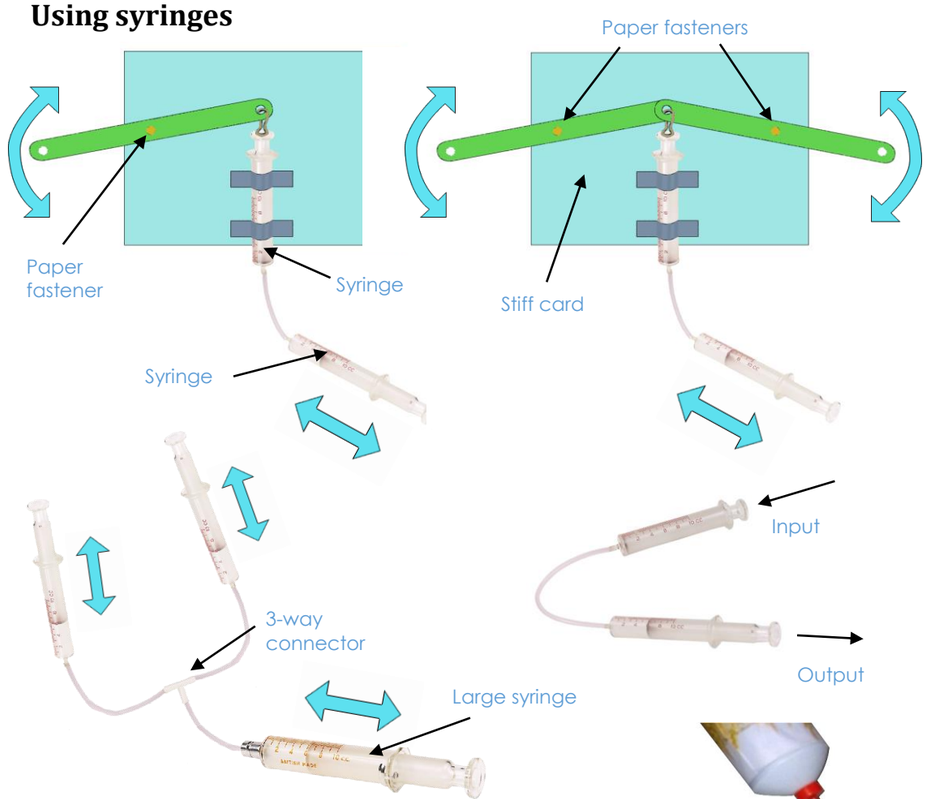
- Mighty mascots
- Working with plastics
- Working with materials

Teaching aids to demonstrate pneumatic systems

Squeeze the bottle (input movement) to inflate the balloon (output movement) and raise the toy.



Using syringes



Design decisions

- Children might use a squeezy bottle and a balloon in a container to raise or lower an object or a lever.
- They might choose to use three syringes connected by a T-connector so that two objects move backwards and forwards.
- Adding levers and linkages allows children to design and make more complex mechanical systems.

Designing, making and evaluating a moving 'creature in a box' toy for small children

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 moving toy shall I make and who will it be for? How will it fit into the box? How will it move? Which parts will move?	Discussing ideas, drawing annotated sketches, generating design criteria.
Which pneumatic system will work best?	Modelling possible systems. Discussing and evaluating mock-ups and prototypes against the design criteria.
What materials will I need?	Discussing, exploring and trialling 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.
How will I finish it so that it looks attractive?	Discussing, exploring and trialling materials.
More thoughts … appraising, reflecting, refining.	More actions … building, testing, modifying.
Will the finished toy meet the needs of the user?	Evaluating the toy with the intended user and against the design criteria.

Glossary

- **Compressed** – something that is squashed, such as air in a tube.
- **Input** – what goes into a system.
- **Output** – what comes out of a system.
- **Pivot** – a point about which a lever turns.
- **Lever** – a beam which turns about a point.
- **Pneumatic** – a system that works using gases (air).
- **Hydraulic** – a system that works using liquids (water).
- **Pressure** – the force used on an object or surface.
- **Inflate** – fill something with air or a gas to make it swell up.
- **Deflate** – remove the pressurised air to allow an object like a balloon to shrink.
- **Syringe** – a tube with a nozzle and plunger for sucking and blowing air or liquids.
- **System** – a set of related parts or components used to create an outcome. Systems have an input, process and an output. In a pneumatic system, the 'input movement' is where the user pushes or pulls a syringe or pump. The 'output movement' is where the object at the end of the tube moves.

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

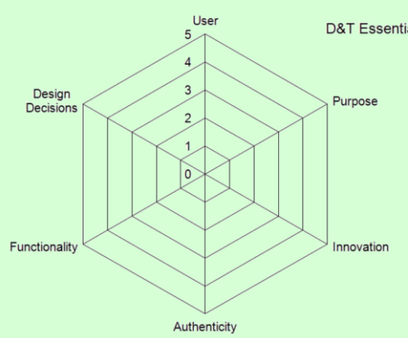
18. Key competencies

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.

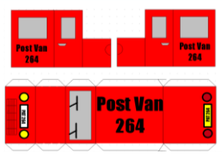
20. Overall potential of project



Years 3/4

Structures
Shell structures using CAD

Instant CPD



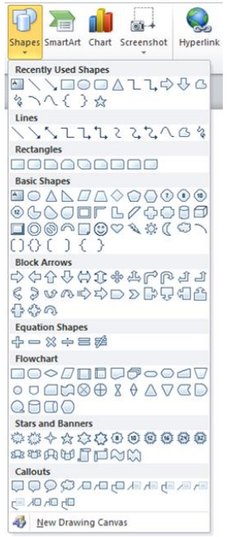

Tips for teachers

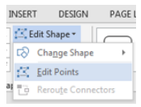
- ✓ Please also refer to the Instant CPD guidance in 'Year 3/4 Structures – shell structures' when carrying out this project
- ✓ Many software packages have demonstration versions with tutorials that you can try out without paying a charge.
- ✓ Visit a local shop or supermarket to investigate different 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

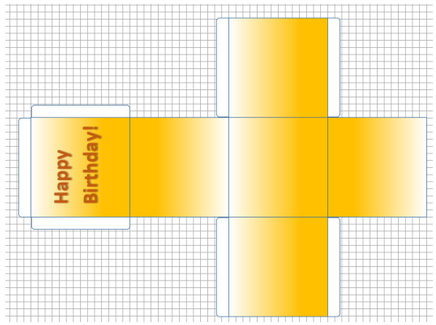




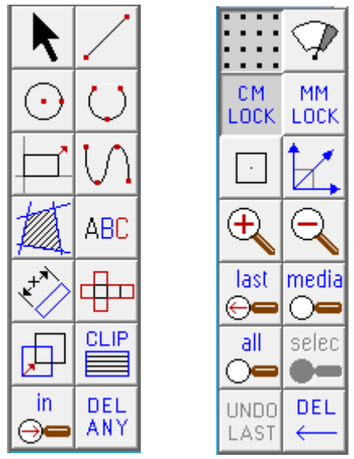
Turn on gridlines and use the pre-set shapes to draw simple nets. Shapes can be edited if you choose.

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.

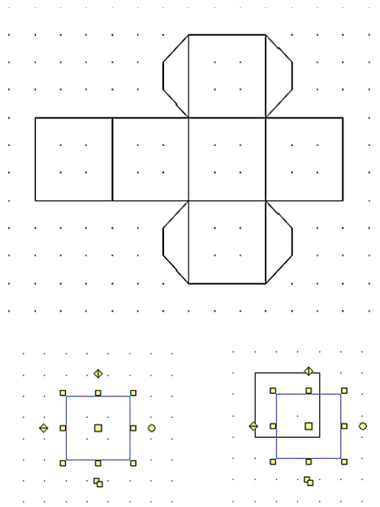


Using TechSoft 2D Primary



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.

1. Year Groups

Years 3/4

2. Aspect of D&T

Structures

Focus

Shell structures

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.

Designing

- Generate realistic ideas and design criteria collaboratively through discussion, focusing on the needs of the user and purpose of the product.
- Develop ideas through the analysis of existing products and use annotated sketches and prototypes to model and communicate ideas.

Making

- Order the main stages of making.
- Select and use appropriate tools 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 finishing techniques suitable for the product they are creating.

Evaluating

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

4. What could children design, make and evaluate?

gift boxes/containers desk tidy
disposable/recyclable lunchboxes packaging
cool boxes party boxes keep safe boxes
mystery boxes other – specify

5. Intended users

themselves siblings parents
relatives friends younger/older children
party guests neighbours other – specify

6. Purpose of products

celebration storage packaging
protection marketing presentation display
postage other – specify

7. Links to topics and themes

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

8. Possible contexts

home school 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)

- Children use kit parts with flat faces to construct nets. Practise making nets out of card, joining flat faces with masking tape to create 3-D shapes. Experiment with assembling in nets in numerous ways.
- Demonstrate skills and techniques of scoring, cutting out and assembling using pre-drawn nets. Then allow children to practise by constructing a simple box. Show how a window could be cut out and acetate sheet added.
- Demonstrate how to use different ways of stiffening and strengthening their shell structures e.g. folding and shaping, corrugating, ribbing, laminating. Provide opportunities for the children to practise these and to carry out tests to find out where their structures might need to be strengthened or stiffened.
- Children discuss and explore the graphics techniques and media that could be used to achieve the desired appearance of their products.
- Practise using computer-aided design (CAD) software to design the net, text and graphics for their products according to purposes.

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 shapes 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 with the children the uses and purposes of their shell structures 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 use annotated sketches and prototypes to develop, model and communicate their ideas for the product 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 computer-aided design (CAD) where appropriate.
- 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** – 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, 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

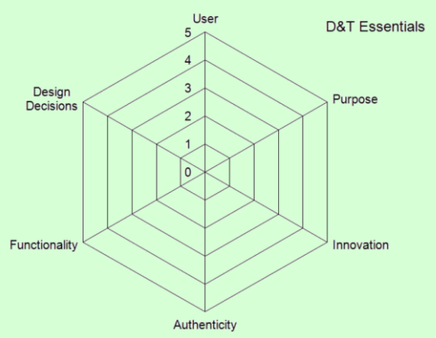
18. Key competencies

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.

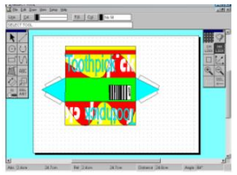
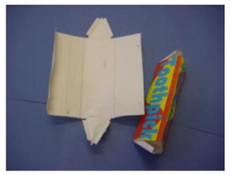
20. Overall potential of project



Years 3/4

Structures
Shell structures

Instant CPD

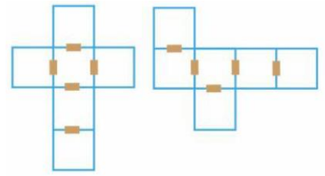

Tips for teachers

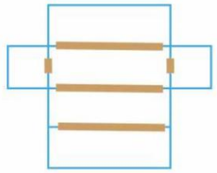
- ✓ Make a collection of boxes of various shapes and flatten them for storage.
- ✓ Discuss environmental issues relating to the wastage of materials when packaging items including the three R's – reducing, recycling and reusing.
- ✓ Visit a local shop or supermarket to investigate different types of card packaging.
- ✓ The use of an empty ball point pen together with a safety rule is ideal for scoring.
- ✓ The use of standard shapes as templates will help children design their own nets.
- ✓ Ensure that the children have sufficient tabs for assembling their nets.
- ✓ Consider the use of enlarge and reduce facilities on the photocopier when copying 2-D nets for the children as examples.
- ✓ Display technical vocabulary to encourage the children to use it when discussing, designing and making their product.
- ✓ Divide your class into teams and assign children to specific jobs within their teams e.g. Resources Manager, Sustainability Officer, Design Director, Tools Manager, Process Controller, Graphics Director.
- ✓ The use of computer-aided design to draw nets and graphics for the children's products could be practised in computing lessons.
- ✓ Ensure that the children have a good understanding of 2-D and 3-D shapes in maths before carrying out this project.

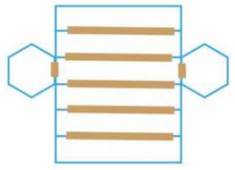
Useful resources at www.data.org.uk

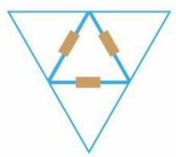
- Primary Subject Leaders' File Section 5.9
- Banish broken biscuits! Box them brilliantly
- Desk Tidy
- Working with Materials
- Packaging – with links to Maths
- Nets for packaging helpsheet
- Door hinges helpsheet

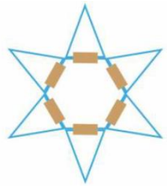
Assemble and evaluate 3-D shapes using standard sized card squares, rectangles, equilateral triangles, isosceles triangles and hexagons, joined with masking tape.

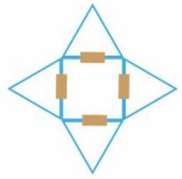

Nets for cubes

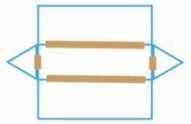

Cuboid net


Hexagonal prism net

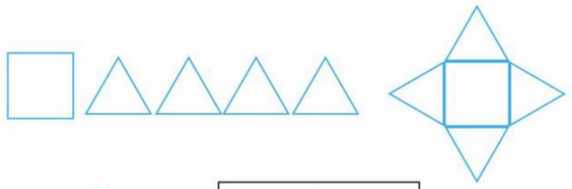

Tetrahedron net

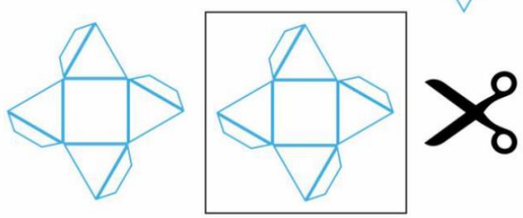

Hexagonal based pyramid net


Square based pyramid net

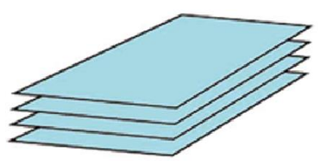

Triangular prism net

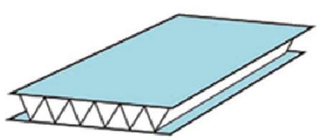
Creating the net for the product you are designing and making without using computer aided design:

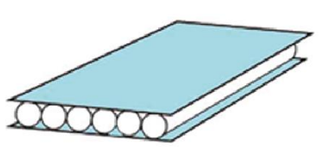

Draw the faces and stick them together

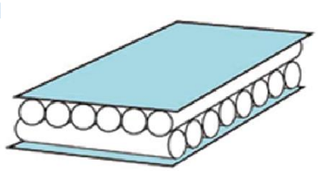

Add tabs, glue your paper net onto card and cut out

Stiffening and strengthening sheet materials:


Laminating – glue together several layers of card


Corrugating – zig-zag a piece of paper or card and glue in between two layers of card


Ribbing – glue layers of straws between layers of card



Designing, making and evaluating packaging for a gift for a family member

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 shell structure shall I make? What will be the purpose of my product? How will my product appeal to my intended user?	Discussing ideas, drawing annotated sketches, generating design criteria.
Which materials will I use to make it?	Investigating and evaluating possible materials.
Which shape will be the best for my structure? How will I stiffen and strengthen my structure?	Discussing, constructing and comparing different nets. Exploring strengthening techniques. Evaluating prototypes against success criteria.
What graphics techniques will I use to achieve a desired visual effect and purpose?	Discussing, exploring, trialling and evaluating different graphics 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

- **Cuboid** – a solid body with rectangular sides.
- **Edge** – where two surfaces meet at an angle.
- **Face** – a surface of a geometric shape.
- **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.
- **Prism** – a solid geometric shape with ends that are similar, equal and parallel.
- **Scoring** – cutting a line or mark into sheet material to make it easier to fold.
- **Shell structure** – a hollow structure with a thin outer covering.
- **Vertex** – used to refer to the corners of a solid geometric shape, where edges meet.

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

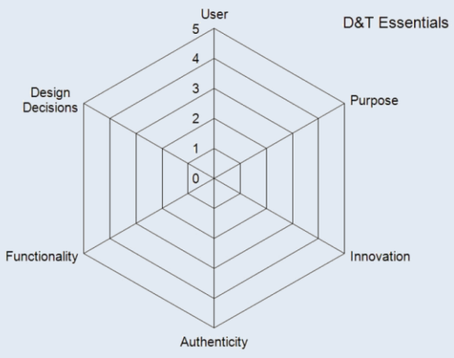
18. Key competencies

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

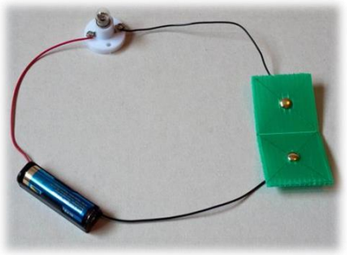


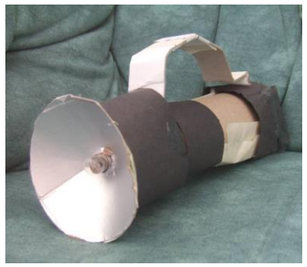
Years 3/4

Electrical Systems

Simple circuits and switches

Instant CPD





Tips for teachers

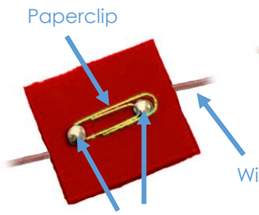
- ✓ This project should be undertaken either around the same time or soon after electricity is covered in science.
- ✓ Use a selection of images of existing battery-powered products to add to the actual products that children investigate and evaluate.
- ✓ Check the condition of the batteries prior to 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.

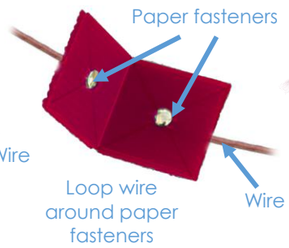
Useful resources at www.data.org.uk

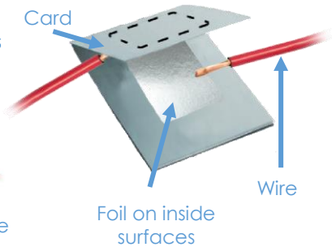
- Torches, Lamps and Lanterns
- Developing Handmade Switches
- Night lights (links to Literacy)
- Handmade Switches Helpsheet
- Alarming Vehicles

Making secure connections

Handmade switches

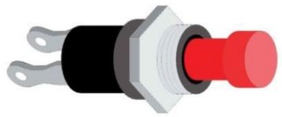






Commercial switches

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:

THOUGHT	ACTION
What sort of night light shall I make and who will it be for? What parts will it have? How will it appeal to the user?	Discussing ideas, drawing annotated sketches, cross-sectional and exploded diagrams, generating design criteria.
What switch will work best for my night light?	Discussing ideas, modeling possible electrical circuits.
How will I make the base, casing and shade?	
Who will I work with? How long will it take? What order will I work in?	Discussing, exploring and trialling materials.
	Negotiating, developing and agreeing a plan of action.
More thoughts… appraising, reflecting, refining.	More actions… assembling, testing and modifying.
More thoughts… appraising, reflecting, refining.	More actions… assembling, testing and modifying.
Will the night light meet the needs of the user and achieve its purpose?	Evaluating the nightlight with the intended user and against design criteria.

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.

1. Year Groups

Year 3/4

2. Aspect of D&T

Electrical systems

Focus

Simple programming and control

3. Key learning in design and technology

Prior learning

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

Designing

- Gather information about users' needs and wants, and develop design criteria to inform the design of products that are fit for purpose.
- 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.
- Connect simple electrical components and a battery in a series circuit to achieve a functional outcome.
- Program a standalone control box, microcontroller or interface box to enhance the way the product works.

Evaluating

- Investigate and analyse a range of existing battery-powered products, including pre-programmed and programmable 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 computing to program and control products containing electrical systems, such as series circuits incorporating switches, bulbs and buzzers.
- Know and use technical vocabulary relevant to the project.

4. What could children design, make and evaluate?

illuminated sign noise-making toy vehicle
nightlight display lighting
other – specify

5. Intended users

themselves younger children older children
teenagers parents shoppers friends
school general public other – specify

6. Purpose of products

hobbies and interests utility pleasure
advertising comfort illumination
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 shops
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 and safe, disassemble different examples of relevant battery-powered products, including some programmable and programmed commercially available products e.g. *Where and why the products are used? How do they work? What are the key features and components? How does the switch work? Is the product manually controlled or controlled by a computer? If it is controlled by a computer how does that improve the way the product works? 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? How might different output devices be used?*
- 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, programmable 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, motors and buzzers. Discuss which of the components in the circuit are input devices e.g. switches, and which are output devices e.g. bulbs, motors and buzzers.
- Demonstrate how to find a fault in a simple circuit and correct it, giving pupils opportunities to practise.
- Demonstrate and ask children to practise the use of a simple computer control program using an interface box, microcontroller or standalone control box to control output devices, e.g. bulbs and buzzers, using a repeating sequence of instructions.
- 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, programmable products that they will be designing and making and how they will work more effectively for the intended user than those that are manually controlled. Consider who they will be for and how they address a problem or need.
- 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.
- Have the children write, test and debug programs that will control the electrical product they have made for a clearly defined purpose e.g. bulb on a nightlight switching off after a period of time when the user has gone to sleep or LEDs flashing on and off to illuminate a sign in a shop window.
- Evaluate throughout and the final products against the intended purpose and, where safe and practical, 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

microcontroller or a standalone control box or an interface box

collection of battery-powered, manually-controlled and programmable electrical products

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

plastic packaging, card, corrugated plastic, reclaimed materials, finishing media

output devices including buzzers, bulbs, bulb holders, LEDs, zinc carbon or zinc chloride batteries, battery holders, wire, automatic wire strippers 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, light emitting diode (LED), bulb, bulb holder, USB cable, wire, insulator, conductor, crocodile clip

control, program, system, input device, output device, process

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

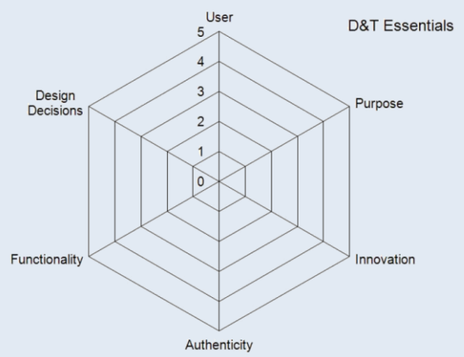
18. Key competencies

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

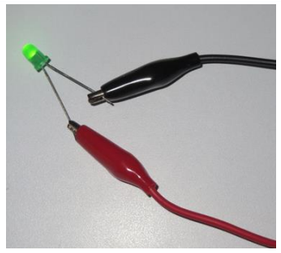


Years 3/4

Electrical Systems

Simple programming and control

Instant CPD


Tips for teachers

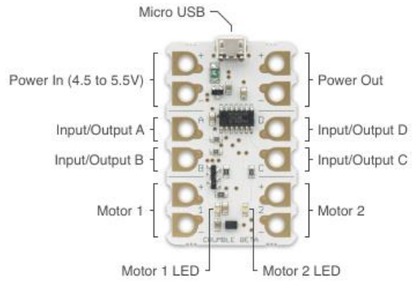
- ✓ Please also refer to the Instant CPD guidance in 'Year 3/4 Electrical systems – simple circuits and switches' when carrying out this project.
- ✓ Clean plastic drinks bottles or clear plastic packaging can be used to make housings for nightlights.
- ✓ Do this project around the same time or just after electricity is covered in science lessons.
- ✓ Build up a collection of battery-powered manual and programmable products, such as nightlights, for children to investigate and evaluate.
- ✓ Crocodile clips can be difficult for small fingers to manipulate. Stress the need for making secure connections.
- ✓ Set up a 'working' circuit so that children can test suspect components.
- ✓ Some components (e.g. buzzers and LEDs) need to be connected the right way round in a circuit, ensuring positive and negative match the poles of the interface box (e.g. FlowGo) or microcontroller (e.g. Crumble).
- ✓ Light emitting diodes (LEDs) with internal resistors should be used.
- ✓ Use 1.5v AA zinc carbon or zinc chloride batteries.
- ✓ Do not use alkaline, lithium or rechargeable batteries.
- ✓ Use Crumble-friendly battery boxes with a built-in resettable fuse to protect against short circuits.
- ✓ Teach children how to avoid making short circuits.
- ✓ 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.

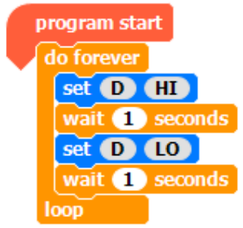
Useful resources at www.data.org.uk

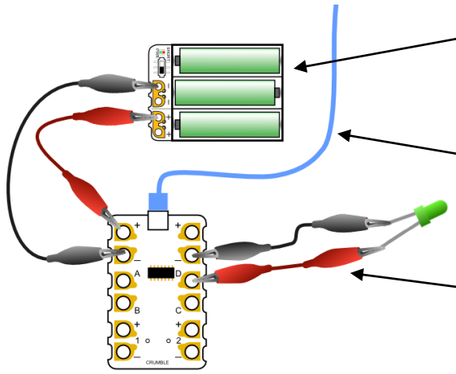
- Crumble kit suitable for KS2 and related guidance
- Primary Subject Leaders' File Sections 5.8 and 5.10
- Applying Computing in D&T at KS2 and KS3
- Torches, Lamps and Lanterns
- Developing Handmade Switches
- Night lights (links to Literacy)
- Handmade Switches Helpsheet

Connecting up a Crumble and an example program

This arrangement is for a nightlight or an illuminated sign that flashes on and off, using a light emitting diode (LED) as the output device.







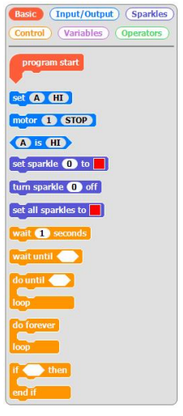
A battery box (including three 1.5v AA zinc carbon batteries) connects to the Crumble's Power In pads. Switch the battery box off when not in use.

A USB cable connects the Crumble to a computer.

The +ve (red) lead is connected to the long leg of the LED and the –ve (black) lead to the short leg. The +ve lead connects to output A, B, C or D on the Crumble and the -ve lead connects to the –ve Power Out pad.

Simple programming and control

Crumble drag and drop interface and menus



Dragging blocks from the interface allows them to snap into place.

Click the green arrow to start the program.

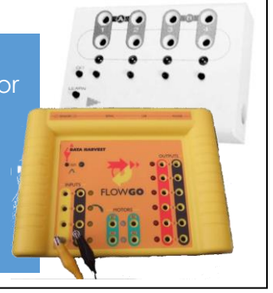
Once the Crumble has been programmed, it will remember the program and run it automatically when the USB cable is disconnected.

You might alter the nightlight program by including a time limit for the light to shine after it is turned on.

Control boxes and program ideas

An alternative to the Crumble or similar microcontrollers is a simple standalone control box or an interface box. Interface boxes sometimes use programming software in the form of flowcharts.

Instructions and example programs can be easily found on the internet and adapted for use in products that children wish to design and make.



Designing, making and evaluating a personalised, programmable nightlight for themselves or another child

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 nightlight shall I make and who will it be for? What parts will it have? How will it appeal to the user?	Discussing ideas, drawing annotated sketches, cross-sectional and exploded diagrams, generating design criteria.
How will I control my night light so that it turns on and off when I want it to? How will it be powered?	Discussing ideas, modelling possible electrical circuits and programs.
What will I use as a housing to contain the parts of the product?	Discussing, exploring and trialling materials.
Who will I work with? How long will it take? What order will I work in? Which solution works best?	Negotiating, developing and agreeing a plan of action.
How shall I decorate it to make it appealing to a child/myself?	More actions… trialing, testing and modifying the program and design.
More thoughts … appraising, reflecting, refining.	Discussing, exploring and trialling possible solutions and options.
Will the nightlight meet the needs of the user and achieve its purpose?	Evaluating the nightlight with the intended user, where safe and practical, and against design criteria.

Glossary

- **Program** – a sequence of instructions that can be used to control electrical components.
- **Microcontroller** – a device that can be programmed to control how an electrical product operates.
- **Light emitting diode (LED)** – an output device that glows when electricity is passed through it.
- **System** – a set of related parts or components that together achieve a desired outcome.
- **Output devices** – components that produce an outcome e.g. bulbs, motors and buzzers.
- **Input devices** – components that are used to control an electrical circuit e.g. switches.
- **Process** – how a computer program controls one or more output devices.

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 Our Community
Forces and Motion Mini-enterprise
Festivals Celebrations
other – specify

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

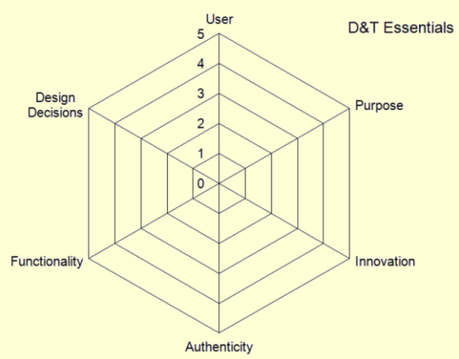
18. Key competencies

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 5/6

Mechanical systems
Cams

Instant CPD

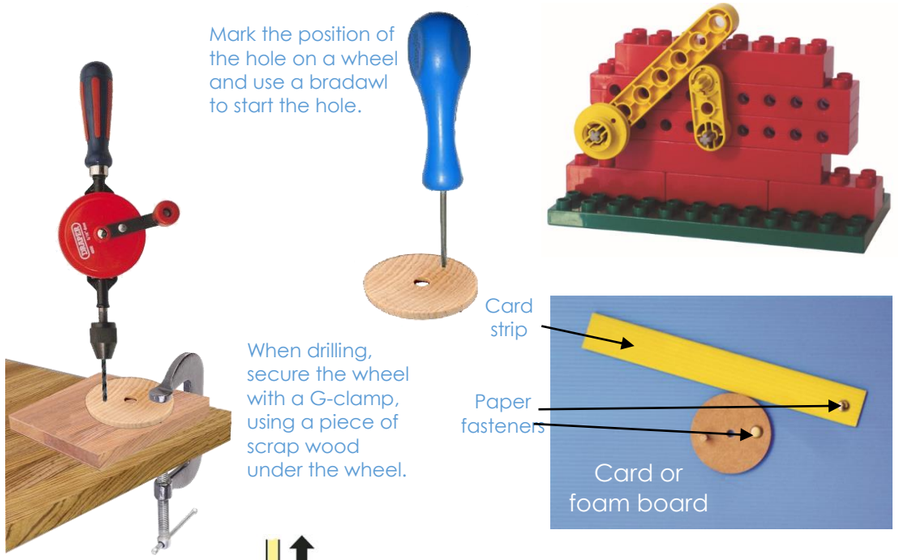
Tips for teachers

- ✓ 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

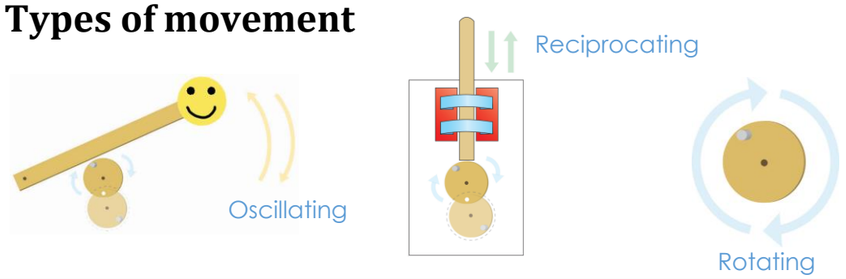
- Primary Subject Leaders' File Section 5.8
- Levers and Linkages
- Working with wheels and axles
- Mechanisms with a message
- Gears and Pulleys
- Fairgrounds

Making teaching aids to demonstrate cams

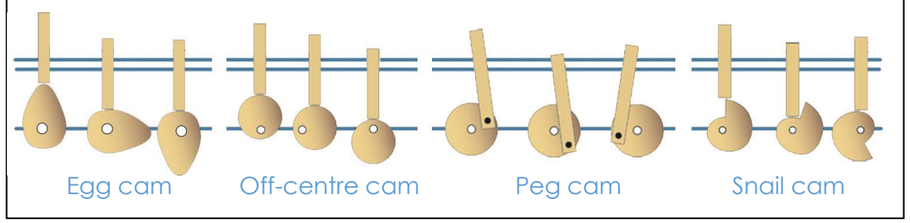


A more complex cam-based mechanism with rotary and reciprocating movement.

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 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

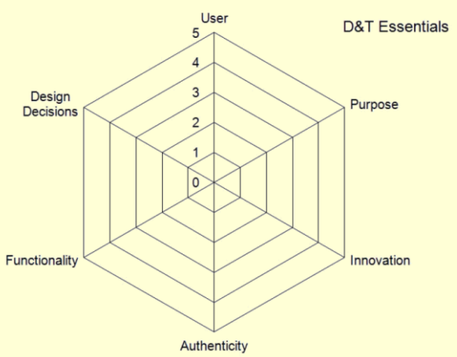
18. Key competencies

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

Food

Celebrating culture and seasonality

Instant CPD

Tips for teachers

- ✓ When rubbing in flour and fat, keep ingredients and hands cool.
- ✓ The purpose of kneading bread is to strengthen the gluten (the protein in grain such as wheat). It normally takes about 10-12 minutes by hand. When ready the dough will be smooth, elastic and hold its shape.
- ✓ When developing a product e.g. soup, that requires chopping and slicing of ingredients refer to the Y3/4 Food Project Planner.
- ✓ Limit the number of ingredients added to the basic recipe and discuss when is the best time to add the new or changed ingredient(s).
- ✓ Emphasise the importance of accurate weighing and measuring.
- ✓ Some supermarkets and bakeries will allow children to visit. This could be linked to an enterprise project with a class-based food company.
- ✓ Children could design packaging for their food products as part of work on structures linked to mathematics.
- ✓ Carry out a survey to find out which cultural/seasonal food products are preferred by family and friends.
- ✓ For homework, encourage children to grow edible plants such as herbs.

Useful resources at www.data.org.uk

- Christmas Ginger Biscuits
- Willy Wonka's Fair Trade Cookies
- Making Bread using the Six Essentials
- Are you Teaching Food in Primary D&T?
- A to Z of D&T
- Make it Safe!

Other useful web-based resources:

- www.foodafactoflife.org.uk

Possible products

Biscuits

Savoury scones

Savoury muffins

Possible techniques that children could use

Mixing to combine ingredients if making savoury muffins or scones

Rubbing in to mix fat and flour if making a yeast-based product

Kneading a bread dough

Sensory evaluation

When carrying out sensory evaluations of products and/or separate ingredients, begin with a whole class activity then use group work to develop ideas.

Example of a recording table:

Type of cultural/seasonal food product	Appearance	Smell	Texture	Taste
Savoury scone	Golden/rough	Fresh/baked	Crumbly	Cheesy

Children can also use simple ranking and rating tables as well as star diagrams.

Use packaging and/or the internet to find out about the nutritional content of the food products and the ingredients. Link this to the principles of a healthy and varied diet.

Edible plants grown in the school grounds can also be evaluated and considered as potential ingredients for products the children will later design, make and evaluate. The benefits/difficulties of selecting seasonal, organic and/or locally sourced ingredients can be discussed here.

Designing, making and evaluating a yeast-based snack for parents and children participating in the school sports day

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

- **Finishing** – related to the appearance of the product – shape, decoration and colour.
- **Rubbing in** – rubbing the dry ingredients together with the fat, lifting to put air into the mixture, so that it resembles fine breadcrumbs.
- **Knead** – pulling and squeezing dough to make it smooth.
- **Bran** – the hard, protective shell of a grain of wheat.
- **Dough** – a mixture of flour, yeast and water before it is cooked.
- **Endosperm** – the store of food inside a seed.
- **Germ** – part of the seed where the root and shoots grow from.
- **Yeast** – a tiny plant which makes bubbles of carbon dioxide when mixed with flour and warm water.
- **Unleavened bread** – flat bread where yeast has not been added.

1. Year Groups

Years 5/6

2. Aspect of D&T

Textiles

Focus

Combining different fabric shapes

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.

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.

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.

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.

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

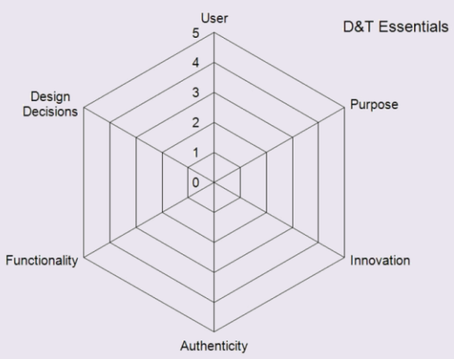
18. Key competencies

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 5/6

Textiles

Combining different fabric shapes

Instant CPD

Tips for teachers

- ✓ Choose fabrics carefully. Shiny, heavyweight or fabrics that fray easily are often difficult to work with and can be frustrating. Have fabric cut into manageable sizes.
- ✓ Investigate using materials other than fabrics e.g. for handles. Plastic bags can be cut into strips and plaited.
- ✓ To make the activity more manageable limit the choice of decorating techniques.
- ✓ Keep scissors for fabric only.
- ✓ Make sure that you have plenty of pins and needles for children to use.
- ✓ Arrange zones in the class where children will find materials and resources.
- ✓ Ensure children have a basic understanding of stitching techniques, threading needles, starting and finishing off.
- ✓ Make mock-ups, then alter and refine and go back to initial design ideas to amend as necessary e.g. change measurements. Ensure the children keep all their modifications as part of the ongoing evaluation and for their final evaluation.
- ✓ Enlist the help of a local textile designer if available.
- ✓ Children can make their own demonstration videos to show e.g. how to join in different ways or how to complete a range of stitches. Different groups could show how to do different tasks and then share them.
- ✓ If using sewing machines, either hand or electric, make sure that their use is very closely supervised, using, for example, trained adult volunteers. If this cannot be achieved, children can tack the fabric together and an adult can use the machine.

Useful resources at www.data.org.uk

- Designing with textiles
- Designer bags
- A to Z of D&T
- Working with Materials
- Recycling to sell
- Butterflies in My Tummy

Teaching aids – fasteners

Children may want to use a fastener which should be appropriate for the purpose for the product.

Zip

Velcro

Clasp

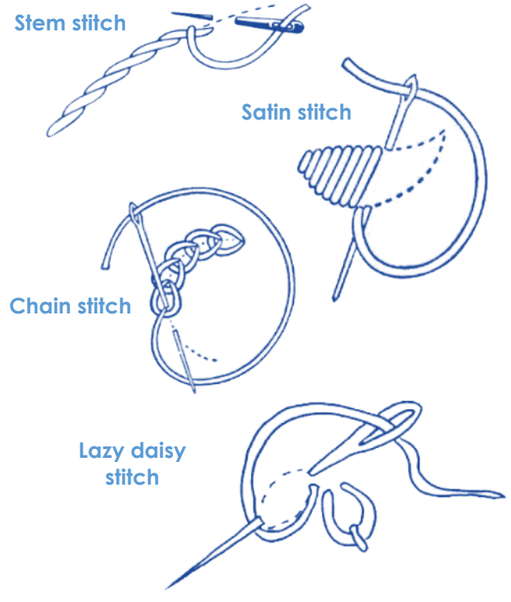
Toggles

Ties

Buttons

Press studs

Stitches



Using stitches as a finish for the product.

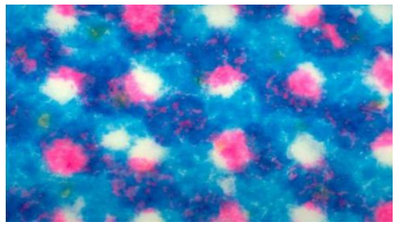
The children could design their finish for their product using a variety of appropriate stitches. They could draw enlarged examples of e.g. insects, flowers, animals and then decide which stitch would be best for each part. Use square paper for a grid to ensure the stitches are in the right place and are the right size.

Appliqué

Embroidery

Tie Dye

Children could decorate their fabric before they make up their product by tie dyeing.



The key to success is to tie the fabric very tightly with e.g. rubber bands or string so that the dye is prevented from reaching that part of the fabric.

Designing, making and evaluating a belt for garden tools

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 are the features of a successful product? What features do I need to include in a functional, innovative and authentic product?	Researching, investigating, disassembling and evaluating existing products and consulting 'real life' designers.
What knowledge and skills do I need to be able to design and make a good quality product?	Investigating and practising using a range of methods to join fabrics together and making judgments about the strength and appropriateness of each technique. Practising finishing techniques and, if possible, learning to use a sewing machine.
How do I make a paper pattern for the product I want to produce?	
What design decisions do I need to make? How can I communicate my ideas for my product in an effective way?	Creating a 2-D paper pattern with a seam allowance.
How will I show innovation? Who will be the user of my product and what are their needs, wants and values? What will be the purpose of my product?	Developing ideas through research, working drawings, computer-aided design, discussion, paper mock-ups and modelling.
More thoughts… appraising, reflecting, refining.	Thinking about the user and purpose and developing specifications for products. Formulating a clear plan of work and allocating tasks if appropriate.
Does my product meet the needs and wants of the user? Is it appealing and does it fulfill a purpose? Is it innovative?	Constantly self-evaluating and making changes if the product is not fulfilling the specification.
	Testing final products with the intended user and making an evaluation of how successful they are.

Glossary

- **Mock up** – quick 3-D modelling using easy to work and cheaper materials and temporary joints. Useful for checking proportions and scale.
- **Pattern or template** – a shape drawn to exact shape and size, used to assist in cutting out.
- **Seam allowance** – extra fabric allowed for joining together - 15mm for domestic patterns.
- **Specification** – describes what a product has to do.
- **Tacking** – large running stitches to hold pieces of fabric together temporarily.
- **Working drawing** – detailed drawing contains all information needed to make a product but is updated as changes are made.

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

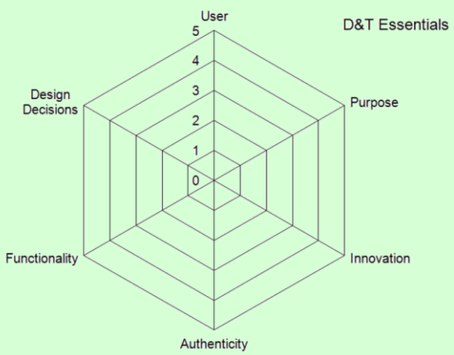
18. Key competencies

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



Years 5/6

Structures
Frame structures

Instant CPD



Tips for teachers

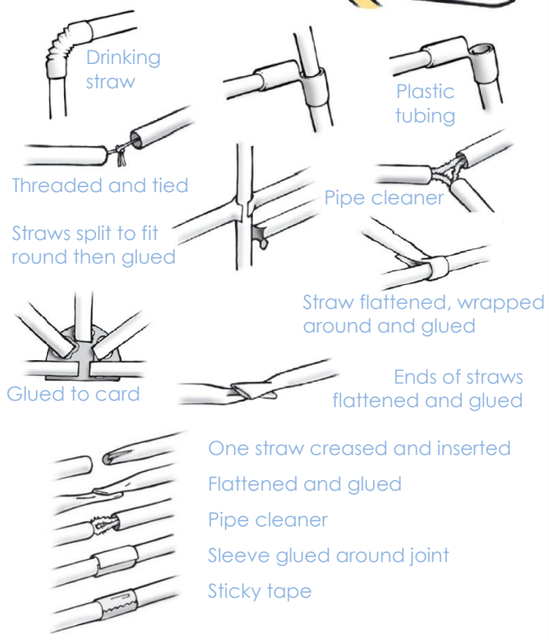
- ✓ Collect a range of photographs of different frame structures, both portable and permanent e.g. tents, bus shelters, bird hides.
- ✓ Include examples constructed with external and internal frameworks.
- ✓ Record the process of investigating frame structures using photographs and annotated drawings.
- ✓ 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

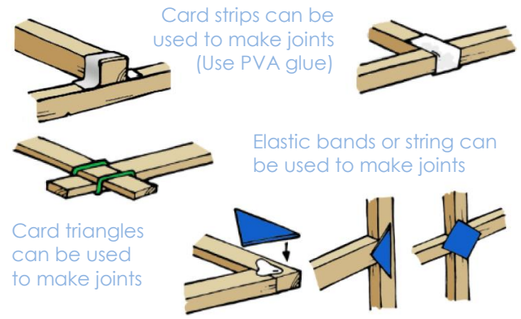
- Primary Subject Leaders' File Section 5.9
- Bird Hides Dragons' Den Challenge
- Working with paper straws

Techniques for building frame structures

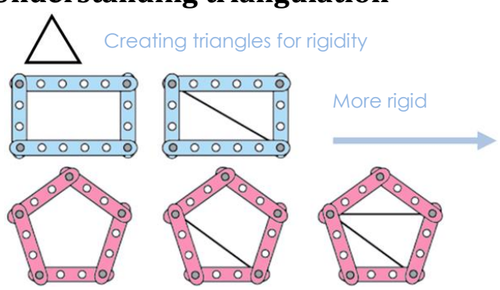
Joining straws



Joining thin sectioned pieces of wood

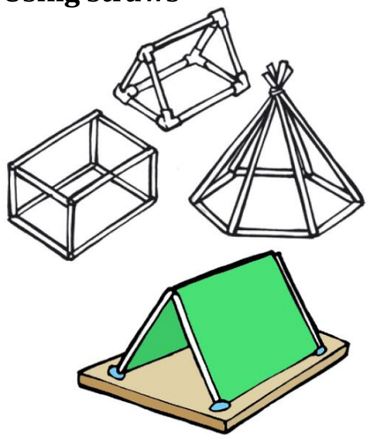


Understanding triangulation

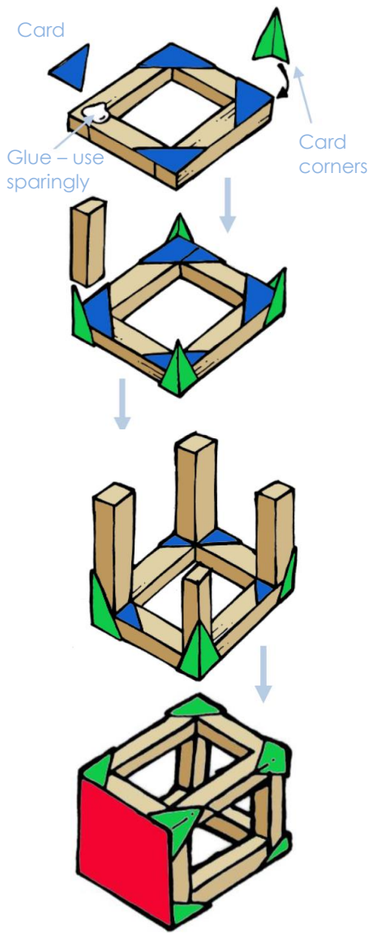


Making small-scale frame structures

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

Electrical systems

Focus

Monitoring and control

3. Key learning in design and technology

Prior learning

- Initial experience of using computer control software and an interface box, a standalone box or microcontroller, e.g. Crumble.
- Some experience of writing and modifying a program to make a light turn on or flash on and off.
- Understanding of the essential characteristics of a series circuit and experience of creating a battery-powered, functional, electrical product.

Designing

- Develop a design specification for a functional product that responds automatically to changes in the environment.
- Generate, develop and communicate ideas through discussion, annotated sketches and 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 their electrical product to respond 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.

Technical knowledge and understanding

- Understand and use electrical systems in their products.
- Understand the use of computer control systems in 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?

cycle or vehicle alarm security lighting system
alarm for valuable artefact garden light
automatic nightlight electronic moneybox
alarm for school shed other – specify

5. Intended users

vehicle or cycle owner school community
school administrator themselves siblings
parents security staff 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)

- Discuss a range of relevant products (such as nightlights, garden lights, alarm systems, security lighting, electronic moneyboxes) that respond to changes in the environment using a computer control program e.g. *Why is a computer control program used to operate the products? What are the advantages of using computer control? What input devices, e.g. switches, and output devices, e.g. bulbs and buzzers, have been used? Who have the products been designed for and for what purpose?*
- Investigate sensors such as light dependent resistors (LDRs) and a range of switches such as push-to-make, push-to-break, toggle, micro 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.
- Using a model circuit, demonstrate and enable children to practise using different input and output devices. Allow them to practise methods for making secure electrical connections e.g. using wire strippers, twist and tape connections, screw connections, crocodile clips and connecting blocks.
- Remind children how to avoid making short circuits.
- 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 and modify computer control programs that include inputs, outputs and decision making. Test out the programs using electrical components connected to microcontrollers, interface boxes or standalone boxes.

13. Related learning in other subjects

- **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.
- **Mathematics** – apply understanding and skill to carry out accurate measuring using standard units i.e. cm/mm.
- **Spoken language** – asking questions to check understanding, develop technical vocabulary and build knowledge.

14. Design, Make and Evaluate Assignment (DMEA)

- Develop an authentic and meaningful design brief with the children.
- Ask the children to 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, including the microcontroller, interface box or standalone box to be used. 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. Reference should be made to the control program used and how it will operate to control the inputs and outputs.
- 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.
- **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.

16. Possible resources

microcontroller or standalone control box or interface box

collection of battery-powered, manually-controlled and programmable products

batteries, battery holders, crocodile leads

different output devices including bulbs with bulb holders, buzzers, light emitting diodes (LEDs), motors

different input devices including micro switches, reed switches and magnets, light dependent resistors (LDRs)

wire, automatic wire strippers, masking tape, construction materials and tools as required

17. Key vocabulary

reed switch, toggle switch, push-to-make switch, push-to-break switch, light dependent resistor (LDR), tilt switch

light emitting diode (LED), bulb, bulb holder, battery, battery holder, USB cable, wire, insulator, conductor, crocodile clip

control, program, system, input device, output device, series circuit, parallel circuit

function, innovative, design specification, design brief, user, purpose

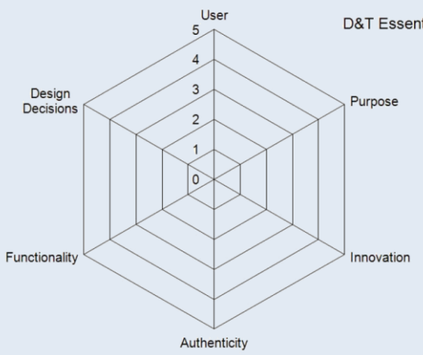
18. Key competencies

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



Years 5/6

Electrical Systems

Monitoring and control

Instant CPD

Tips for teachers

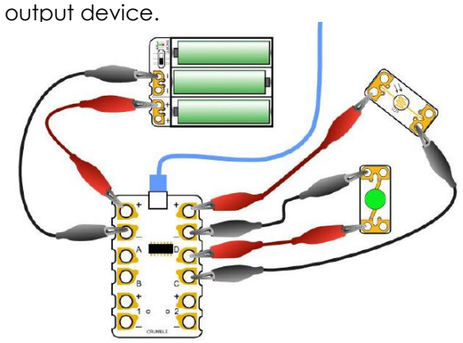
- ✓ Please also refer to the guidance in 'Year 5/6 More complex switches and circuits' and 'Year 3/4 Simple programming and control' when carrying out this project.
- ✓ To ensure progression from Y3/4, children need to develop an understanding of 'monitoring' as well as control and the idea of 'input' as well as 'output'.
- ✓ Ask children to save different versions of their programs as evidence of using an iterative process.
- ✓ Check the condition of the batteries prior to activities.
- ✓ Set up a 'working' circuit so that children can test suspect components.
- ✓ Make sure electrical components and batteries match e.g. 1.5v bulb with a 1.5v battery.
- ✓ Some components (e.g. buzzers and LEDs) need to be connected the right way around in a circuit, ensuring positive and negative match the outputs of the interface box or microcontroller.
- ✓ If you are using the Crumble microcontroller, look online for example projects that others have completed.
- ✓ Avoid looking directly at the Sparkle LEDs as they are very bright.
- ✓ Teach children how to avoid making short circuits.
- ✓ If children are designing and making an electronic moneybox, to lessen the risk of a short-circuit use plastic coins as 'money'.
- ✓ Use 1.5v AA zinc carbon or zinc chloride batteries.
- ✓ Do not use rechargeable, lithium or alkaline batteries.
- ✓ Switch off the Crumble's battery box when not in use.
- ✓ Use Crumble-friendly battery boxes with a built-in resettable fuse to protect against short circuits.
- ✓ Use light emitting diodes (LEDs) with internal resistors. Use non-mercury tilt switches.

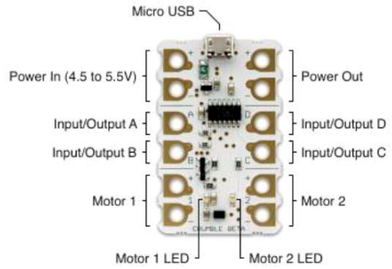
Useful resources at www.data.org.uk

- Primary Crumble Controller Starter Kit
- Crumble-friendly Components Pack
- Primary Subject Leaders' File Sections 5.8 and 5.10
- Applying Computing in D&T at KS2 and KS3
- Alarming vehicles
- Designing and making alarm circuits using inputs with computer control
- Developing handmade switches
- Hand-made switches helpsheet

Connecting up a Crumble

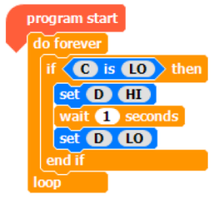
This arrangement is for an automatic nightlight, using a light dependent resistor (LDR) as the monitoring or input device and a light emitting diode (LED) as the output device.

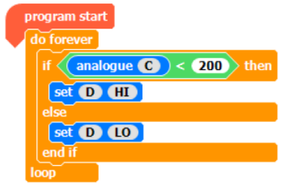




Example programs for an automatic nightlight

The LED connected to output D switches on when it goes dark. Change the value of the LDR connected to terminal C so that the system is activated at different light levels.



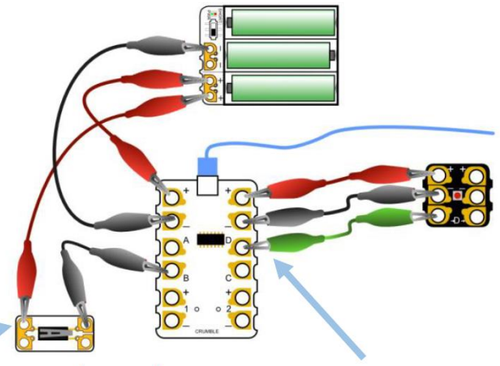


LED – connect +ve to D and -ve to Power Out

LDR – connect -ve to C and +ve to Power Out

An example program for an electronic toy moneybox

A sparkle LED is connected to the Crumble and changes from green to yellow to red every time a plastic coin is placed through the slot of the moneybox and depresses a micro switch connected to terminal B.



Connect the crocodile clips to 'common' and 'normally open' on the micro switch. Connect the +ve lead to a +ve terminal on the battery box and –ve lead to B.

Use the 'D' output for sparkles.

- How could children adapt the program so that it would detect a burglar stealing the moneybox?
- What type of output device could they use?
- What type of switch could detect the movement of the moneybox?
- How could the program be adapted to remind the user to save money on a regular basis?

Once the Crumble has been programmed, it will remember the program and run it automatically when the USB cable is disconnected.

Designing, making and evaluating an electronic toy moneybox for a child

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

- **Program** – a sequence of instructions that can be used to control electrical components.
- **Microcontroller** – a device that can be programmed to control how an electrical product operates.
- **Light emitting diode** (LED) – an output device that glows when electricity is passed through it.
- **System** – a set of related parts or components that together achieve a desired outcome.
- **Output devices** – components that produce an outcome e.g. bulbs, motors and buzzers.
- **Input devices** – components that are used to control an electrical circuit e.g. switches.
- **Process** – how a computer program controls one or more output devices.

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

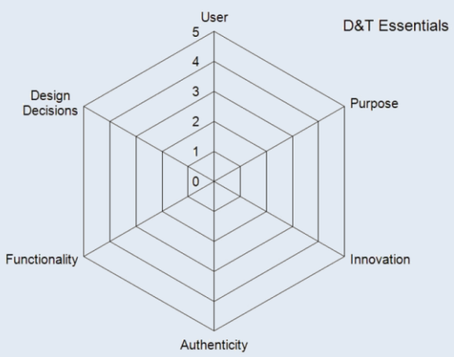
18. Key competencies

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

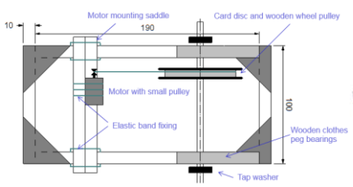


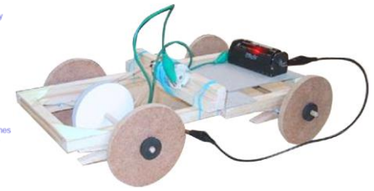
Years 5/6

Electrical Systems

More complex switches and circuits

Instant CPD





Tips for teachers

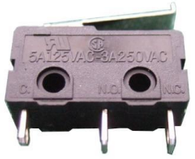
- ✓ To ensure progression from Y3/4, children need to develop an understanding of 'monitoring' as well as control and the idea of 'input' as well as 'output'.
- ✓ This project should be undertaken soon after electricity is covered in science and programming, monitoring and control are undertaken in computing.
- ✓ Create a selection of images of existing products e.g. burglar alarm and outdoor security lighting, that use monitoring and control.
- ✓ Discuss the difference between products that rely upon timed events, such as traffic lights, and those that depend upon monitoring to make something happen such as a security alarm.
- ✓ Some children will be ready to use parallel circuits in their electrical systems and this enables two or more sensors or switches to be incorporated in their products.
- ✓ Have a 'working' circuit set up so that children can test suspect components.
- ✓ Some components e.g. buzzers and light emitting diodes (LEDs) need to be connected the right way round in a circuit, ensuring positive and negative match the poles of the battery.
- ✓ Make sure electrical components 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.
- ✓ Use non-mercury tilt switches.

Useful resources at www.data.org.uk

- Torches, Lamps and Lanterns
- Alarming Vehicles
- Designing and making alarm circuits using inputs with computer control

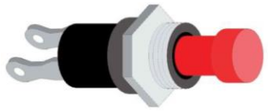
Switches and sensors

Latching switch

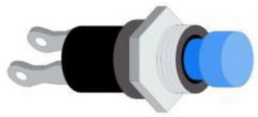


Micro-switch

Light-dependent resistor (LDR)



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



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

Reed switch
Activated by a magnet which closes the contacts.

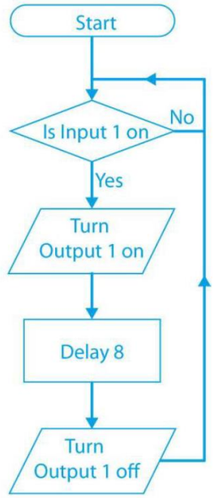
Tilt switch
When tilted a ball bearing bridges the contacts inside, completing the circuit.

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

Standalone control box

Interface control box

Example control program



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

Designing, making and evaluating an alarm to protect a valuable artefact

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 will my alarm be for? What will it protect? Who will control it? What components will it need?	Developing innovative ideas through discussion and annotated sketches, generating a design specification.
Which switches or sensors should I use? What output devices should I use?	Discussing ideas, modelling possible electrical circuits. Recording design ideas pictorially or using circuit diagrams.
What tools and components will I need? What sequence of steps will I use?	Developing a step-by-step plan.
How can computer control improve my alarm system?	Writing and testing programs and connecting to a control box.
More thoughts… appraising, reflecting, refining.	More actions… assembling, testing, modifying.
Will the alarm achieve its purpose?	Evaluating the alarm against the original design specification.

Glossary

- **Modelling** – to realise and manipulate ideas in a tangible form.
- **Open switch** – when a switch is positioned such that electricity cannot flow through it.
- **Closed switch** – when a switch is positioned such that electricity can flow through it.
- **Normally open** – the term used to describe when a switch is in the off position, i.e. the switch is open and no electricity can flow when the button on not pressed.
- **Normally closed** – the term used to describe when a switch is in the on position i.e. the switch is closed and electricity can flow when the button is not pressed
- **Computer control input** – when a switch, such as a micro switch, sends a signal to a computer control box to activate a sequence of events such as a buzzer or light being used to attract attention or alert people.
- **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 or sensors.

1. Year Groups

Years 5/6

2. Aspect of D&T

Mechanical systems

Focus

Pulleys or Gears

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 electrical circuits, simple switches and components.
- 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 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.
- Investigate famous manufacturing and engineering companies relevant to the project.

Technical knowledge and understanding

- Understand that mechanical and electrical systems have an input, process and an output.
- Understand how gears and pulleys can be used to speed up, slow down or change the direction of movement.
- Know and use technical vocabulary relevant to the project.

4. What could children design, make and evaluate?

fairground ride with gears or pulleys e.g. carousel, Ferris wheel
controllable toy vehicle with gears or pulleys e.g. dragster, off-road vehicle, sports car, lorry,
window display with moving parts e.g. lifting or turning items for sale other – specify

5. Intended users

peers siblings younger children
older children specific individuals
target groups company other – specify

6. Purpose of products

entertainment pleasure play
educational interests and hobbies
business other – specify

7. Links to topics and themes

Festivals Celebrations Travel and Tourism
Mini-enterprise Forces and Motion
Outdoor adventure Toys and Games
Our Community other – specify

8. Possible contexts

home school leisure enterprise
wider environment local community
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)

- Investigate, analyse and evaluate existing everyday products and existing or pre-made toys that incorporate gear or pulley systems. Use videos and photographs of products that cannot be explored through first-hand experience.
- Use observational drawings and questions to develop understanding of each product in the collection 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, process and output 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. Jaguar Land Rover, JCB, local companies

11. Related learning in other subjects

- **Spoken language** – ask relevant questions, formulate and express opinions, give well-structured descriptions and explanations. Use relevant strategies to build their vocabulary.
- **Computing** – use search technologies for research purposes and be discerning when evaluating digital content.

12. Focused Tasks (FTs)

- Using a construction kit, investigate combinations of two different sized pulleys to learn about direction and speed of rotation e.g. *How many times does the smaller pulley turn each time the larger pulley turns once? Do the pulleys move in the same direction? How can you reverse the direction of rotation?*

AND/OR

- Using a construction kit, explore combinations of two different size gears meshed together. Investigate the direction and speed of rotation focusing on how the size of the driver gear affects the speed of the follower gear. Ask the children to use the number of teeth on each gear to decide upon the gear ratios e.g. 10 tooth driver gear meshed with a 20 tooth follower gear produces a ratio of 2:1
- Build a working circuit that incorporates a battery, a motor and a handmade switch, such as a reversing switch. Demonstrate the accurate use of tools and equipment including cutting and stripping wire, and making secure electrical connections. Remind children about the dangers of mains electricity. Draw a pictorial representation of the circuit or draw a circuit diagram using correct symbols.
- Develop measuring, marking, cutting, shaping and joining skills using junior hacksaws, G-clamps, bench hooks, square section wood, card triangles and hand drills to construct wooden frames, as appropriate. Demonstrate the accurate use of tools and equipment.

13. Related learning in other subjects

- **Spoken language** – ask relevant questions, formulate and express opinions, give well-structured descriptions and explanations. Use relevant strategies to build their vocabulary.
- **Mathematics** – understand ratios. 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. Recognise that some mechanisms, including pulleys and gears, allow a smaller force to have a greater effect.

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 drawings from different views and/or exploded diagrams. The drawings should indicate the design decisions made, including the location of the mechanical and electrical components, how they work as a system with an input, process and output, 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

- **Computing** – use search technologies for research purposes and be discerning when evaluating digital content.
- **Art and design** – use and apply drawing skills. Use techniques with colour, pattern, texture, line and shape.
- **Science** – apply knowledge and understanding of circuits, switches, conductors and insulators in the design of the final product.
- **Mathematics** – understand ratios. Apply understanding and skill to carry out accurate measuring using standard units i.e. cm/mm.

16. Possible resources

videos, photographs and everyday products or toys with pulleys or gears

batteries, battery holders, wires, crocodile clips, motors, switches, aluminium foil, paper fasteners, paper clips, card, motors, motor stands, dowel, paper sticks

consumable and construction kit pulleys or gears of different sizes, elastic bands

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

PVA glue, sticky pads, masking tape, dowel, double-sided tape, card triangles, square section wood, card, corrugated plastic, finishing media

17. Key vocabulary

pulley, drive belt, gear, rotation, spindle, driver, follower, ratio, transmit, axle, motor

circuit, switch, circuit diagram

annotated drawings, exploded diagrams

mechanical system, electrical system, input, process, output

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

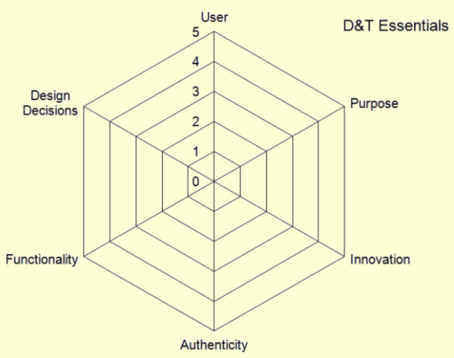
18. Key competencies

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

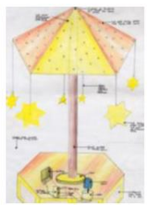


Years 5/6

Mechanical systems Pulleys or Gears

Instant CPD





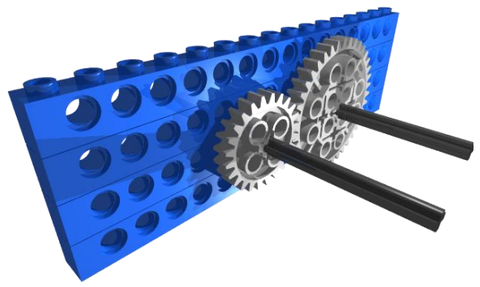
Tips for teachers

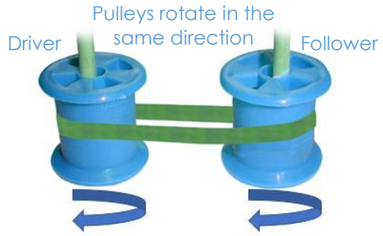
- ✓ Sourcing existing products with gears or pulleys can sometimes be difficult. Example products using construction kits or consumable materials can be premade for children to investigate.
- ✓ When beginning designing and making, ensure children are focused on making the mechanical system work, rather than the decoration.
- ✓ Focused tasks should concentrate on exploring combinations gears or pulleys using construction kits. If you do not have construction kits, attach bought pulleys and gears to cardboard using paper fasteners.
- ✓ Gears require more accuracy than pulleys at the making stage but make it easier for children to understand the concept of ratio by counting the number of teeth on each gear.
- ✓ The key to success in these units is to use components that are compatible with each other e.g. components purchased should have the same diameter holes.
- ✓ 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 of incorporating any failed designs into displays of final products. Include evaluations of why 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.
- ✓ Do not use rechargeable, lithium or alkaline batteries as these can overheat if short circuited.

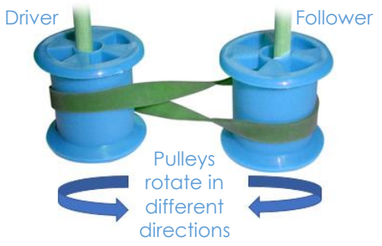
Useful resources at www.data.org.uk

- Levers and Linkages
- Developing Handmade Switches
- Handmade Switches Helpsheet
- Gears and Pulleys
- Fairgrounds

Developing understanding of gears and pulleys

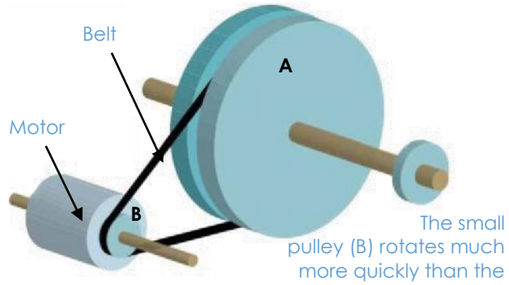




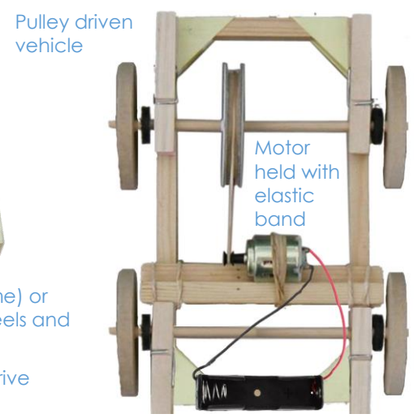


Using construction kits, ask children to explore gear ratio using combinations of two gears e.g.

No. teeth	Ratio
8, 16	2:1
8, 40	5:1
8, 24	3:1
40, 40	1:1

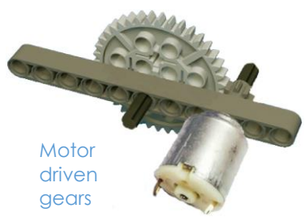


Building gears or pulleys into children's products

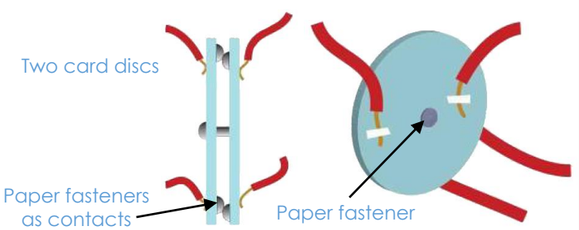


Construct a chassis using wooden strips (frame) or corrugated plastic. Add a pulley and/or wheels and an electric motor with battery housing.

The chassis can be used for a vehicle or to drive machines such as fairground rides.



An example of a handmade reversing switch



Designing, making and evaluating a new toy vehicle 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 toy vehicle 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 electrical and mechanical components shall I use?	Discussing, modelling and evaluating different systems using mechanical and electrical components.
Which materials will I use to make it? How will I make fit for purpose?	Investigating and trialling possible materials and components.
How will I make the body shell for my toy vehicle?	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

- **Pulley** – a grooved wheel over which a drive belt can run.
- **Gear** – a wheel with teeth around its circumference.
- **Drive belt** – the belt which connects and transfers movement between two pulleys.
- **Gearing up or down** – changing the rotational speed of a product by the use of pulleys or gears. When a small pulley or gear is used to drive a larger one the rotational speed is reduced and the product has been geared down.
- **Mechanical system** – a set of related parts or components used to create movement.
- **Driver** – the gear or pulley that provides the input movement to the system.
- **Follower** – the gear or pulley that provides the output movement to the system.
- **Mesh** – the point where two gears join together and transfer movement.
- **Motor spindle** – the rod on the end of the motor onto which a gear or pulley is attached.

1. Year Groups

Years 5/6

2. Aspect of D&T

Textiles

Focus

Using computer-aided design (CAD) in textiles

3. Key learning in design and technology

Prior learning

- Experience of stitching, joining and finishing techniques in textiles.
- Experience of making and using textiles pattern pieces.
- Experience of simple computer-aided design applications.

Designing

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

Making

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

Evaluating

- Investigate and analyse textile products linked to their final product.
- Compare the final product to the original design specification.
- Test products with intended user, where safe and practical, and critically evaluate the quality of the design, manufacture, functionality and fitness for purpose.
- Consider the views of others to improve their work.

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.

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.

10. Investigative and Evaluative Activities (IEAs)

- Children investigate and evaluate a range of existing textiles products and how they have been constructed using disassembly, and evaluate what the fabric shapes look like, how the parts have been joined, how the product has been strengthened and stiffened, what fastenings have been used and why.
- Investigate work by designers and their impact on fabrics and products. Use questions to develop understanding 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? How has it been made? What has been used to enhance the appearance? Is the design innovative?*
- 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 different viewpoints.
- **Science** – work scientifically investigating properties of fabrics. Plan different types of scientific enquiries to answer questions.
- **History** – significant people in their locality who are linked to textiles.

12. Focused Tasks (FTs)

- Develop computer-aided design (CAD) skills by using pattern making software to generate, modify, scale, save and print pattern pieces. Recognise that designs can be easily modified and repeated on the computer without the need for a physical product. Investigate using art packages on the computer to design prints that can be applied to textiles using iron transfer paper.
- Develop skills of 2-D paper pattern making using CAD and create a 3-D paper or Dipryl mock-up of a chosen product. Remind/teach how to pin a pattern on to fabric ensuring limited wastage, how to leave a seam allowance and use different cutting techniques.
- Develop skills of threading needles and joining textiles using a range of stitches, building upon children's earlier experiences of stitches e.g. improving appearance and consistency of stitches and introducing new stitches. If available, demonstrate and allow children to use sewing machines to join fabric with close adult supervision.
- Develop skills of sewing textiles by joining right side together and making seams. Children should investigate how to sew and shape curved edges by snipping seams, how to tack or attach wadding or stiffening and learn how to start and finish off a row of stitches.

13. Related learning in other subjects

- **Computing** – select, use and combine a variety of software to design and create a range of patterns and other content that accomplish given goals, including presenting data and information.
- **Mathematics** – apply knowledge of how 2-D patterns can be joined to make 3-D products; apply skills of accurate measuring using standard units i.e. cm/mm.
- **Art and design** – investigate methods of adding colour, pattern and texture on to textiles through appliqué, iron transfer paper and/or dye sublimation.

14. Design, Make and Evaluate Assignment (DMEA)

- Set an authentic and meaningful design brief. Children generate ideas by carrying out research using surveys, interviews, questionnaires and the internet. Develop a design specification for their product.
- Communicate ideas through detailed, annotated drawings from different perspectives. Drawings should indicate the design decisions made, methods of strengthening, the type of fabrics to be used and the types of stitching that will be incorporated.
- Produce step-by-step plans, lists of tools equipment, fabrics and components needed. Allocate tasks within a team if appropriate.
- Develop their design using CAD software to produce pattern pieces and art programmes to produce decoration and design prints that can be applied to textiles.
- Make high quality products applying knowledge, understanding and skills from IEAs and FTs. Incorporate simple computer-aided manufacture (CAM) if appropriate e.g. printing on fabric. Use a range of techniques to ensure a well-finished final product that matches the intended user and purpose.
- Evaluate both as the children proceed with their work and the final product in use, comparing the final product to the original design specification. Critically evaluate the quality of the design, the manufacture, functionality, innovation shown and fitness for intended user and purpose, considering others' opinions. Communicate the evaluation in various forms e.g. writing for a particular purpose, giving a well-structured oral evaluation, speaking clearly and fluently.

15. Related learning in other subjects

- **Computing** – children express themselves and develop ideas using a range of information and communication technology resources.
- **Art and design** – use and apply drawing skills including art programmes on the computer.
- **Spoken language** – consider and evaluate others' viewpoints. Give a well-structured oral evaluation to include relevant technical vocabulary.

16. Possible resources

computer software such as Techsoft 2D Primary, Wild Things by Wild Ginger, Paint and Microsoft Word

existing textile products linked to their product for investigation and deconstruction

wide selection of textiles including reclaimed and reusable fabrics, Dipryl, paper for making mock-ups

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

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

17. Key vocabulary

computer aided design (CAD), computer aided manufacture (CAM)

font, lettering, text, graphics, menu, scale, modify, repeat, copy, flip

design brief, design criteria, design decisions, innovative, prototype

seam, seam allowance, wadding, reinforce, right side, wrong side, hem, template, pattern pieces

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

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

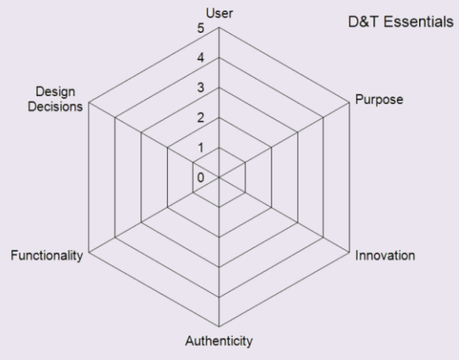
18. Key competencies

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 5/6

Textiles
Using CAD in textiles

Instant CPD

Tips for teachers

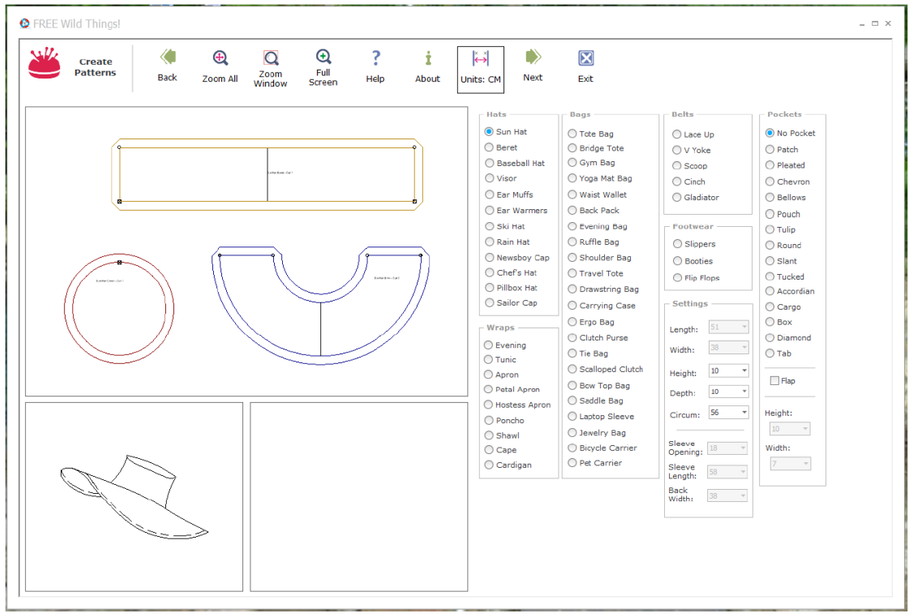
- ✓ Please also refer to the Instant CPD guidance in 'Year 5/6 Textiles – combining different fabric shapes' when carrying out this project.
- ✓ Use software to allow children to make mock-ups without waste or disappointment. They can modify and refine their designs and try out different colours of designs, logo positioning, for example, or save versions and go back to initial design ideas if necessary. Ensure the children keep all their modifications as a record of their ongoing evaluation and for their final evaluation.
- ✓ Many software packages have demonstration versions with tutorials that you can try out without paying a fee. Many are also reviewed online which will help you choose the most appropriate for your class.
- ✓ You may want to put constraints on the range of products being designed to help children concentrate on using the software, developing their knowledge and skills in CAD.
- ✓ Have plenty of inexpensive paper and/or Dipryl available for children to use for mock-ups.
- ✓ Make a collection of different fabric types for children to handle and test.
- ✓ Only responsible Y5/6 children should use irons and this should always be under close supervision.
- ✓ Put together an image board of textiles products that they may use as inspiration.
- ✓ Discuss the environmental issues relating to the wastage of materials, when selecting materials and during designing and making.
- ✓ Ensure that the children include sufficient seam allowance (15mm).
- ✓ Use the program features such as reflect, copy and paste to ensure that objects are of a consistent size.
- ✓ Ensure that the children have a good understanding of the vocabulary associated with using CAD.

Useful resources at www.data.org.uk

- Primary Subject Leaders' File Section 5.6
- Designing with textiles
- Designer bags
- Fancy a Bag
- A to Z of D&T
- Working with Materials

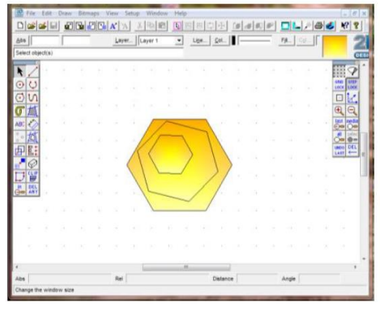
Using Wild Things to create patterns

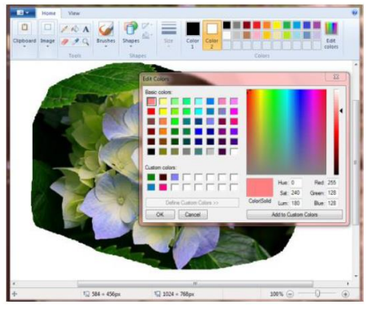
This free software allows you to create patterns for a wide range of products. There are simple as well as more complex designs that you can adapt to your children's needs. The designs are grouped as Hats, Wraps, Bags, Belts and Footwear and it has a range of styles for pockets to add to each item. You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



Software for decorating

You can use a range of paint and draw software to create logos and manipulate digital photos and other images to decorate your pattern mock-ups and as final pieces. Many are freely available, such as Paint, and clip art in Microsoft Word, and you can also find demonstration copies to use at no cost to try before you buy. You may be able to print directly to fabric using iron transfer paper or dye-sublimation printing, perhaps by arrangement with your local secondary school.





Where to find Primary CAD programmes

- 2D Primary is available from www.techsoft.co.uk
- Paint is included in Microsoft Windows
- Free Wild Things is available from www.wildginger.com/products/wildthings.htm

N.B. Although Wild Things software has been used successfully in KS2, it is aimed at the domestic market and includes a link to an online forum. Check your school policy on the use of freely available software before installing.

Designing, making and evaluating a shopping bag for a grandparent using CAD

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
How will my product be used? What size and how heavy should it be? How will my product appeal to my intended user?	Research user needs and ideas.
	Generating and discussing ideas. Generating design criteria. Drawing annotated sketches.
Which materials will I use? Can I use recycled materials? How can CAD help me with my design ideas?	Investigating and evaluating possible tools and materials.
How will I make sure it is strong enough?	Discussing and comparing different construction methods and strengthening techniques.
How can I use CAD/CAM to help with my bag's manufacture? How will I get the graphic effects that I want? What methods of joining the fabric should I use? What fastenings will be best?	Investigating and evaluating possible techniques and methods of manufacture.
	Discussing, exploring, trialling and evaluating fastenings.
Will I work in a team? 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.
Do I need to modify or change anything?	Evaluating prototypes against success criteria.
Will my product meet the needs of the user?	Discussing, trying out and modifying the design. Evaluating the product with the intended user and against the success criteria.

Glossary

- **Mock up** – quick 3-D modelling using easy to work materials. Useful for checking proportions and scale.
- **Pattern/template** – a shape drawn to exact shape and size.
- **Seam allowance** – extra fabric allowed for joining, usually 15mm.
- **Specification** – this describes what a product has to do.
- **Tacking** – large running stitches to hold pieces of fabric together temporarily.
- **Working drawing** – detailed drawing contains all information needed to make the product.
- **CAD** – computer-aided design.
- **CAM** – computer-aided manufacture.