

Design and Technology Whole School Curriculum Map

Year Group	Autumn	Spring	Summer
	7 Areas of Exploration		
Reception DT	Design and Make a 3D object	Mechanisms - Joining and moving techniques.	Food/Textiles Fruit & Vegetable characters Weaving
Year 1 DT	Structures - Playground Equipment Freestanding structures	Mechanisms - Moving Pictures Sliders and levers	Food - Smoothies Preparing fruit and vegetables
Year 2 DT	Food - Fruit & Veg Kebabs Preparing fruit and vegetables	Textiles - Puppets Templates and joining techniques	Mechanisms - Vehicles Wheels and axles
Year 3 DT	Textiles - Purses 2-D shape to 3-D product	Structures - Shelters Shell structures	Food - Wraps Healthy and varied diet
Year 4 DT	Electrical Systems - Torches or Lighthouses Simple circuits and switches	Mechanical Systems - Greetings Cards Levers and linkages	Food - Toasties Healthy and varied diet
Year 5 DT	Mechanical Systems - Fairground Pulleys or gears	Electrical Systems - Crumble Robotic Vehicle More complex circuits and switches	Food - Savory Muffin Celebrating culture and seasonality
Year 6 DT	Structures - Balloon Buggies Tent/playhouse Frame structures	No DT due to SATs Two in Summer Term	Food - Cereal Snack Celebrating culture and seasonality Textiles - Bunting (sewing machine) Combining different fabric shapes

ACCESSART & EYFS: EXPLORING ART IN EARLY YEARS SETTINGS

The 7 Areas of Exploration

WHAT CAN WE SEE?



HOW CAN WE EXPLORE COLOUR?



HOW CAN WE BUILD WORLDS?



HOW CAN WE EXPLORE MATERIALS & MARKS?



HOW CAN WE EXPLORE 3D MATERIALS?



The world is full of materials.

HOW CAN WE USE OUR BODIES TO MAKE ART?



HOW CAN WE USE OUR IMAGINATIONS?



Years 1/2 Structures Freestanding structures

Instant CPD



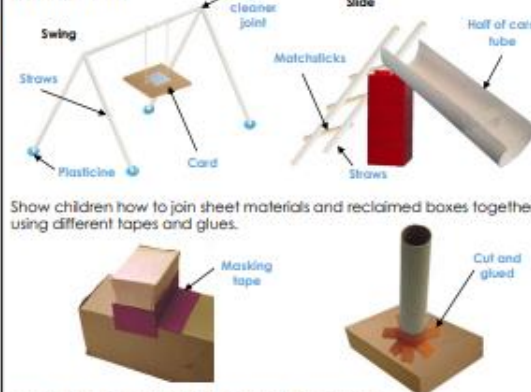
Tips for teachers

- ✓ 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.

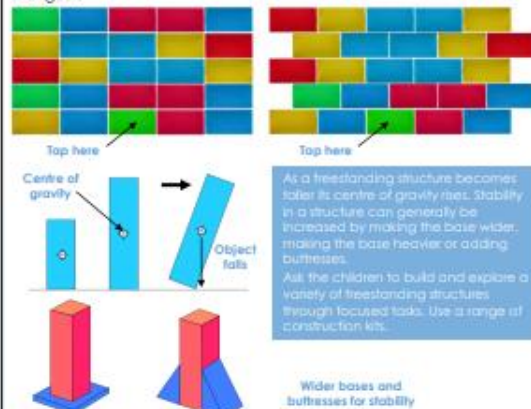
Useful resources at www.data.org.uk

- Door hinges, helioscope
- 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 3-6)
- 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.



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?	Choose an appropriate soft toy
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 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?	Selecting from a range of tools, techniques and materials.
What tools and techniques will I use?	Explaining choices.
What materials shall I use?	More actions... making, testing, modifying.
More thoughts... judging, planning, generating new ideas.	Evaluating the chair with a soft toy and against design criteria.
Will the chair meet the needs of the user and achieve its purpose?	

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.

Structures - Years 1/2 - Freestanding structures

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Years 1/2 Mechanisms Sliders and levers

Instant CPD



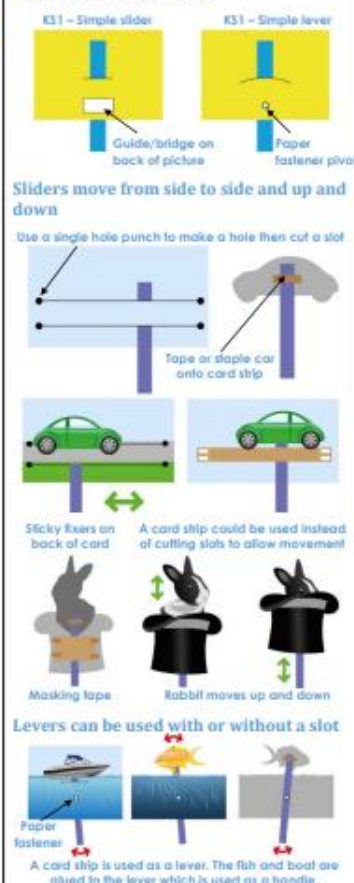
Tips for teachers

- ✓ Using books and prepared examples of simple mechanisms, ask children to explain how the sliders and levers work.
- ✓ Prepare plenty of pre-cut strips of card for making the levers and sliders.
- ✓ To make a small hole for the pivot, a pencil can be used by placing the thin card over a piece of Plasticine or Blu Tack and pressing the pencil through.
- ✓ Guides/bridges can be made using strips of card fixed with masking tape.
- ✓ 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.
- ✓ Mechanisms are operated directly by the children e.g. the slider is pushed and a snail appears from behind a stone.
- ✓ The mechanisms that children use are found in everyday products in the classroom or the school grounds. For example, levers are used to make door handles and sliders are used to make children's toys.
- ✓ Think about directional language e.g. sliders move in a straight line and levers move in a curve.
- ✓ Children may need extra support when they are attaching paper fasteners to levers.

Useful resources at www.data.org.uk

- Moving Pictures (links to literacy)
- Moving history book (Yrs 3/4/5)
- Working with sliders and levers
- Levers and linkages - Father and Sonnet Book
- Mechanisms with a message (Yrs 5/6)
- D&T Primary Issue 17: Focus on Mechanisms

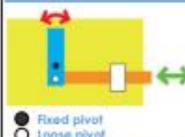
Teaching aids to demonstrate sliders and levers



As an enhancement to this project children could add flaps to their moving pictures. Some children may find flaps, which can be used to make a picture appear and disappear, easier to make than levers or sliders.



Where children have a particularly good understanding of levers and sliders in Key Stage 1, they could be introduced to the simplest lever and linkage mechanism used in Key Stage 2. This will introduce them to the idea of loose and fixed pivots.



Simple mechanisms move...



Designing, making and evaluating a moving storyboard to retell a fairy tale to the class

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 the storyboard for?	Using talk to generate initial ideas, developing simple design criteria
How will we use it? What will make it successful?	Developing and communicating ideas through talk
What will be in each scene? What could move? What captions will we use?	Trying out and evaluating ideas for mechanisms and pictures using inexpensive card and paper
Should we use a lever or a slider for each scene?	Creating moving pictures for each scene of the fairy tale
How will I draw and finish the picture?	Modifying, adapting and improving
Am I working on my own or with others?	More actions...
What is the first thing I/we need to do?	Evaluating the final product against design criteria, when retelling the fairy tale
How well am I doing?	
Are the mechanisms working in the storyboard?	
Evaluating, reflecting, questioning	
More thoughts...	

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.
- **Slider** - a rigid bar which moves backwards and forwards along a straight line. Unlike a lever, a slider does not have a pivot point.
- **Slot** - the hole through which a lever or slider is placed to enable part of a picture to move.
- **Guide or bridge** - a short card strip used to keep sliders in place and control movement.

Mechanisms - Years 1/2 - Sliders and levers

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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 Samahy Bear
- Designing with textiles (7-11 years)

EFPS Resources

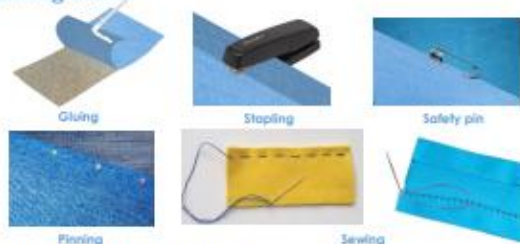
- Three Bears Picnic Blanket
- Let's Look at Hats

Three alternative ways of using templates and simple pattern pieces



Exploring and evaluating joining techniques

Joining fabric



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?	Generating ideas through talking and drawing based on own experiences.
Who is it for and what is it for?	Developing ideas using templates or pattern pieces to create mock-ups.
How can I make sure it fits my hand or finger?	Exploring and evaluating joining techniques.
Which joining technique will work best for my puppet?	Exploring and evaluating media and materials.
What media and materials will I use?	Exploring and evaluating media and materials.
How will I add the features?	What shall I do first?
What shall I do first?	What tools and techniques will I use?
What tools and techniques will I use?	What fabrics shall I use?
What fabrics shall I use?	More thoughts... judging, planning, generating new ideas.
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 use 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.

Textiles - Years 1/2 - Templates and joining

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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.

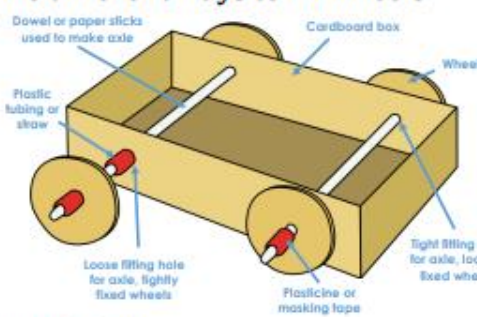
Useful resources at www.data.org.uk

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

EFPS Resources

- Let's Look at Vehicles PowerPoint 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?	Discuss and consider the best size and materials from the wheels available.
What type of wheels will be best?	Talk about the surfaces the trolley might have to travel over.
What does it need to carry?	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. Clearly and model ideas using the boxes.
Do we need 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.

Mechanisms - Years 1/2 - Wheels and axles

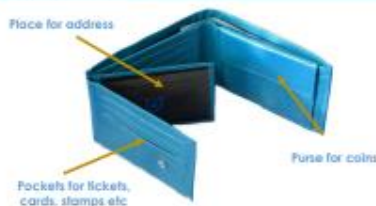
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Year 3

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 dipy 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. pins.

Useful resources at www.data.org.uk

- [Aprons](#)
- [Knacy a bag?](#)
- [Designing with textiles](#)
- [Beady bags](#) (Years 1/2)
- [A to Z of D&T](#)
- [Working with Materials](#)

Teaching aids – joining techniques



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.



Decorative Techniques



Cutting out techniques



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

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

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

Glossary

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

Textiles – Years 3/4 – 2-D shape to 3-D product

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Years 3/4 Structures Shell structures

Instant CPD



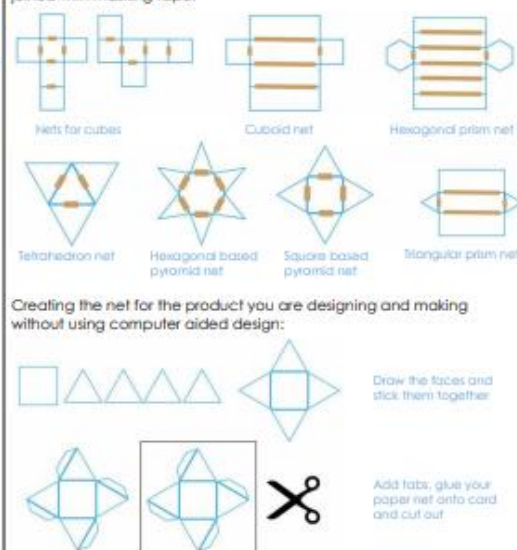
Tips for teachers

- ✓ 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.
- ✓ 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.

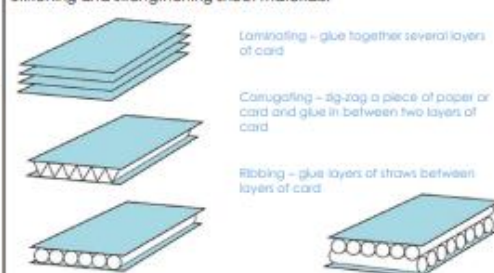
Useful resources at www.data.org.uk

- [Primary Subject Leaders' File Section 5.9](#)
- [English spoken like with: Box them brilliantly](#)
- [Dash-It-Up](#)
- [Working with Materials](#)
- [Packaging – with links to Maths](#)
- [Nets for packaging hallohelmet](#)
- [Box challenges hallohelmet](#)

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



Stiffening and strengthening sheet materials:



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.
What graphics techniques will I use to achieve a desired visual effect and purpose?	Evaluating prototypes against success criteria.
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?	Discussing, exploring, testing and evaluating different graphics effects.
Do I need to adjust or change anything?	Negotiating, developing and agreeing a plan of action, evaluating actions.
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

- **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.

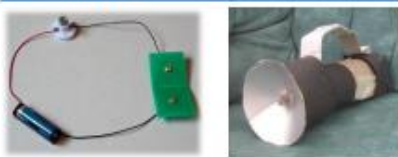
Structures – Years 3/4 – Shell structures

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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 or alkaline as these can overheat if short circuited. Button batteries are not recommended for younger children.

Useful resources at www.data.org.uk

- [Teachers' Lemons and Limes](#)
- [Developing Handmade Switches](#)
- [Night Lights \(links to literacy\)](#)
- [Handmade Switches Worksheet](#)
- [Alarming Vehicles](#)

Making secure connections



Handmade switches



Commercial switches



Standalone control box



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

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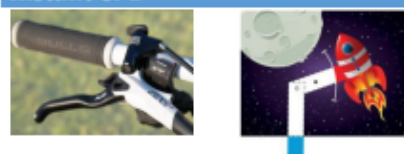
THOUGHT	ACTION
What sort of night light shall I make and who will it be for?	Discussing ideas, drawing annotated sketches, cross-sectional and exploded design criteria.
What parts will it have?	Discussing ideas, modelling possible electrical circuits.
How will it appeal to the user?	Discussing, exploring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

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.

Years 3/4 Mechanisms Levers and linkages

Instant CPD



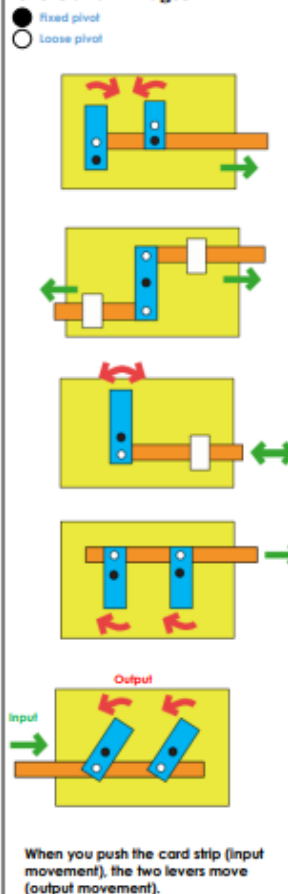
Tips for teachers

- ✓ Give children the opportunity to make examples of lever and linkage mechanisms through 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 to 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

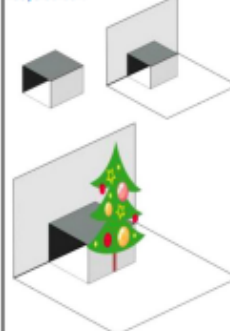
- [Levers and linkages - Poster and Support Pack](#)
- [Mechanisms with a message](#)
- [Moving history book](#)

Teaching aids to demonstrate levers and linkages



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:



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?	Discussing ideas, drawing annotated sketches, generating design criteria.
What parts will it have?	Discussing ideas, modelling possible lever and linkage mechanisms.
How will it appeal to the user?	Discussing, exploring and trialling materials.
How will it move?	Discussing, exploring and trialling materials.
Which lever and linkage mechanism will work best for my greetings card?	Negotiating, developing and agreeing a plan of action.
What media and materials will I use?	More actions... building, testing, modifying.
Who will I work with?	Evaluating the greetings card with the intended user and against design criteria.
How long will it take?	
What order will I work in?	
What tools and techniques will I use?	
More thoughts... appraising, reflecting, refining.	
More thoughts... appraising, reflecting, refining.	
Will the greetings card meet the needs of the user and achieve its purpose?	

Glossary

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

Years
5/6

Mechanical systems Pulleys or Gears

Instant CPD



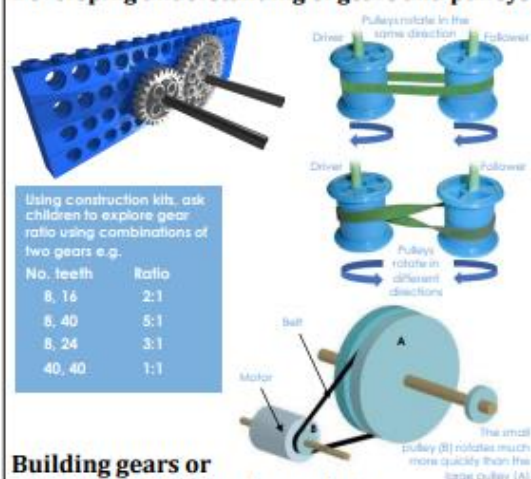
Tips for teachers

- ✓ Sourcing existing products with gears or pulleys can sometimes be difficult. Example products using construction kits or consumable materials can be pre-made 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 of 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 display 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.

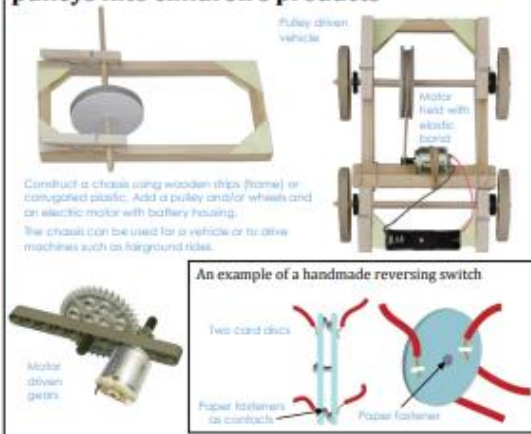
Useful resources at www.data.org.uk

- [Levers and Linkages](#)
- [Developing Handmade Switches](#)
- [Handmade Switches Helioheat](#)
- [Gears and Pulleys](#)
- [Ball Bearings](#)

Developing understanding of gears and pulleys



Building gears or pulleys into children's products



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?	Discussing ideas, drawing annotated sketches or exploded diagrams.
What will be its purpose? Who will use it?	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 it 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.
- **Mech** – 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.

Mechanical systems – Years 5/6 – Pulleys or Gears

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Years 5/6

Electrical Systems Monitoring and control

Instant CPD

Tips for teachers

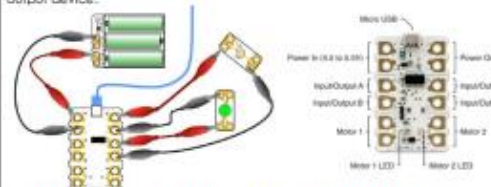
- ✓ Please also refer to the guidance in 'Year 5/6 More complex switches and circuits' and 'Year 3/4 Simple programming and control' when carrying out this project.
- ✓ To ensure progression from Y3/4, children need to develop an understanding of 'monitoring' as well as control and the idea of 'input' 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 resistor. 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 of KS2 and KS3](#)
- [Alarm Vehicles](#)
- [Designing and making alarm circuits using inputs with computer control](#)
- [Developing handmade switches](#)
- [Handmade switches helioheat](#)

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.



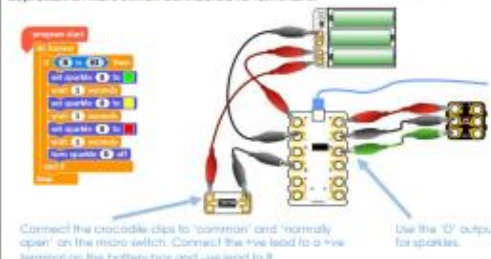
Example programs for an automatic nightlight

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.



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.



- 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?

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:

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

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.

Electrical Systems – Years 5/6 – Monitoring and control

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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
- Art Hides Dragon Den Challenge
- Working with paper straws

Techniques for building frame structures

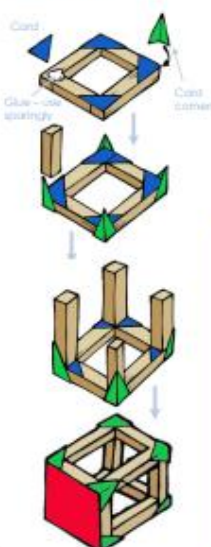


Making small-scale frame structures

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? What look and materials will I need? What order will I work in? Will I work with someone? What constraints I am working to?	Discussing, exploring and evaluating different fabric and rigid covering options.
Do I need to change anything?	Negotiating, developing and agreeing a step-by-step plan.
Will my product meet the needs of the user?	Discussing, testing and modifying the design. 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.

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

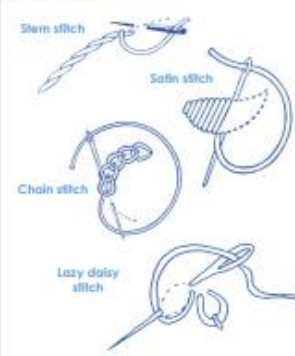
- Designing with textiles
- Designer bags
- A to Z of D&T
- Working with Materials
- Recycling to sell
- Butterflies in My Tummy

Teaching aids – fasteners

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



Stitches



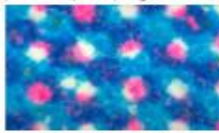
Using stitches as a finish for the product.

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.



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.
How do I make a paper pattern for the product I want to produce?	Practising finishing techniques and, if possible, learning to use a sewing machine.
What design decisions do I need to make?	Creating a 2-D paper pattern with a seam allowance.
How can I communicate my ideas for my product in an effective way?	Developing ideas through research, working drawings, computer-aided design, discussion, paper mock-ups and modelling.
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?	Thinking about the user and purpose and developing specifications for products. Formulating a clear plan of work and allocating tasks if appropriate.
More thoughts... appraising, reflecting, refining.	Constantly self-evaluating and making changes if the product is not fulfilling the specification.
Does my product meet the needs and wants of the user? Is it appealing and does it fulfil a purpose? Is it innovative?	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.