Design and Technology

Clickable Progression Framework KS1 & 2

Design and Technology Association

Expert Subject Advisory Group (ESAG) for D&T

www.data.org.uk

the design and technology association

Clickable Progression Framework KS1 and KS2

This version of the D&T Association/D&T Expert Advisory Group Progression Framework enables subject leaders and classroom teachers to click on particular expectations within the framework that need further exemplification. Clicking on a link causes a 'vignette' to pop up which provides a commentary on what the expectation means, with examples of what children might say or do to meet the expectation and/or how teachers might support children's learning in the classroom.

As a whole, the clickable progression framework is intended to help subject teachers and classroom teachers get a better understanding of age-related standards in design and technology, thereby helping to maximise children's attainment and progress in the subject.

National Curriculum 2014 – expectations which are either derived directly from the programmes of study for D&T or provide an age-related interpretation of the requirements are shown in regular font.

School Curriculum – expectations which are additional to the programmes of study for D&T are shown in italic font.

Health and safety – please note that the vignettes are provided for illustrative purposes only. Risk assessments should be carried out prior to undertaking D&T activities. School, employer and local authority health and safety policy and guidance should be followed.

Use the links at the foot of the pages to navigate to the section you wish to see exemplified, then click on the highlighted expectations to view the vignettes.

Designing

Designing	Key Stage 1	Key Stage 2
Understanding contexts, users and purposes	Across KS1 pupils should: • work confidently within a range of contexts, such as imaginary, story-based, home, school, gardens, playgrounds, local community, industry and the wider environment • state what products they are designing and making • say whether their products are for themselves or other users • describe what their products are for • say how their products will work • say how they will make their products suitable for their intended users • use simple design criteria to help develop their ideas	Across KS2 pupils should: • work confidently within a range of contexts, such as the home, school, leisure, culture, enterprise, industry and the wider environment • describe the purpose of their products • indicate the design features of their products that will appeal to intended users • explain how particular parts of their products work In early KS2 pupils should also: • gather information about the needs and wants of particular individuals and groups • develop their own design criteria and use these to inform their ideas In late KS2 pupils should also: • carry out research, using surveys, interviews, questionnaires and web-based resources • identify the needs, wants, preferences and values of particular individuals and groups • *develop a simple design specification to guide their thinking*
Generating, developing, modelling and communicating ideas	Across KS1 pupils should: • generate ideas by drawing on their own experiences • use knowledge of existing products to help come up with ideas • develop and communicate ideas by talking and drawing • model ideas by exploring materials, components and construction kits and by making templates and mock- ups • use information and communication technology, where appropriate, to develop and communicate their ideas	Across KS2 pupils should: • share and clarify ideas through discussion • model their ideas using prototypes and pattern pieces • use annotated sketches, cross-sectional drawings and exploded diagrams to develop and communicate their ideas • use computer-aided design to develop and communicate their ideas In early KS2 pupils should also: • generate realistic ideas, focusing on the needs of the user • *make design decisions that take account of the availability of resources* In late KS2 pupils should also: • generate innovative ideas, drawing on research • *make design decisions, taking account of constraints such as time, resources and cost*

Making

Making	Key Stage 1	Key Stage 2
Planning	Across KS1 pupils should: • *plan by suggesting what to do next* • select from a range of tools and equipment, *explaining their choices* • select from a range of materials and components according to their characteristics	Across KS2 pupils should: • select tools and equipment suitable for the task • *explain their choice of tools and equipment in relation to the skills and techniques they will be using* • select materials and components suitable for the task • explain their choice of materials and components according to functional properties and aesthetic qualities In early KS2 pupils should also: • *order the main stages of making* In late KS2 pupils should also: • *produce appropriate lists of tools, equipment and materials that they need* • *formulate step-by-step plans as a guide to making*
Practical skills and techniques	Across KS1 pupils should: • follow procedures for safety and hygiene • use a range of materials and components, including construction materials and kits, textiles, food ingredients and mechanical components • measure, mark out, cut and shape materials and components • assemble, join and combine materials and components • use finishing techniques, including those from art and design	Across KS2 pupils should: • follow procedures for safety and hygiene • use a wider range of materials and components than KS1, including construction materials and kits, textiles, food ingredients, mechanical components and electrical components In early KS2 pupils should also: • measure, mark out, cut and shape materials and components with some accuracy • assemble, join and combine materials and components with some accuracy • apply a range of finishing techniques, including those from art and design, with some accuracy In late KS2 pupils should also: • accurately measure, mark out, cut and shape materials and components • accurately assemble, join and combine materials and components • accurately apply a range of finishing techniques, including those from art and design • *use techniques that involve a number of steps* • demonstrate resourcefulness when tackling practical problems

Evaluating

Evaluating	Key Stage 1	Key Stage 2
Own ideas and products	Across KS1 pupils should: • talk about their design ideas and what they are making • make simple judgements about their products and ideas against design criteria • *suggest how their products could be improved*	Across KS2 pupils should: • identify the strengths and areas for development in their ideas and products • consider the views of others, including intended users, to improve their work In early KS2 pupils should also: • refer to their design criteria as they design and make • use their design criteria to evaluate their completed products In late KS2 pupils should also: • critically evaluate the quality of the design, manufacture and fitness for purpose of their products as they design and make • *evaluate their ideas and products against their original design specification*
Existing products	Across KS1 pupils should explore: • what products are • who products are for • what products are for • how products work • how products are used • where products might be used • what materials products are made from • what they like and dislike about products	Across KS2 pupils should investigate and analyse: • how well products have been designed • how well products have been made • why materials have been chosen • what methods of construction have been used • how well products work • how well products achieve their purposes • how well products meet user needs and wants In early KS2 pupils should also investigate and analyse: • who designed and made the products • where products were designed and made • when products were designed and made • whether products can be recycled or reused In late KS2 pupils should also investigate and analyse: • how much products cost to make • how innovative products are • how sustainable the materials in products are • what impact products have beyond their intended purpose
Key events and individuals	Not a requirement in KS1	Across KS2 pupils should know: • about inventors, designers, engineers, chefs and manufacturers who have developed ground-breaking products

Technical knowledge

Technical knowledge	Key Stage 1	Key Stage 2
Making products work	Across KS1 pupils should know: • about the simple working characteristics of materials and components • about the movement of simple mechanisms such as levers, sliders, wheels and axles • how freestanding structures can be made stronger, stiffer and more stable • *that a 3-D textiles product can be assembled from two identical fabric shapes* • *that food ingredients should be combined according to their sensory characteristics* • *the correct technical vocabulary for the projects they are undertaking*	Across KS2 pupils should know: • how to use learning from science to help design and make products that work • how to use learning from mathematics to help design and make products that work • that materials have both functional properties and aesthetic qualities • *that materials can be combined and mixed to create more useful characteristics* • that mechanical and electrical systems have an input, process and output • *the correct technical vocabulary for the projects they are undertaking* In early KS2 pupils should also know: • how mechanical systems such as levers and linkages or pneumatic systems create movement • how simple electrical circuits and components can be used to create functional products • how to program a computer to control their products • how to make strong, stiff shell structures • *that a single fabric shape can be used to make a 3D textiles product* • *that food ingredients can be fresh, pre-cooked and processed* In late KS2 pupils should also know: • how mechanical systems such as cams or pulleys or gears create movement • how more complex electrical circuits and components can be used to create functional products • how to program a computer to monitor changes in the environment and control their products • how to reinforce and strengthen a 3D framework • *that a 3D textiles product can be made from a combination of fabric shapes* • *that a recipe can be adapted by adding or substituting one or more ingredients*

Cooking and nutrition

Cooking and nutrition	Key Stage 1	Key Stage 2
Where food comes from	Across KS1 pupils should know: • that all food comes from plants or animals • that food has to be farmed, grown elsewhere (e.g. home) or caught	Across KS2 pupils should know: • that a recipe can be adapted a by adding or substituting one or more ingredients • that food is grown (such as tomatoes, wheat and potatoes), reared (such as pigs, chickens and cattle) and caught (such as fish) in the UK, Europe and the wider world In late KS2 pupils should also know: • that seasons may affect the food available • how food is processed into ingredients that can be eaten or used in cooking
Food preparation, cooking and nutrition	Across KS1 pupils should know: • how to name and sort foods into the five groups in The eatwell plate • that everyone should eat at least five portions of fruit and vegetables every day • how to prepare simple dishes safely and hygienically, without using a heat source • how to use techniques such as cutting, peeling and grating	Across KS2 pupils should know: • how to prepare and cook a variety of predominantly savoury dishes safely and hygienically including, where appropriate, the use of a heat source • how to use a range of techniques such as peeling, chopping, slicing, grating, mixing, spreading, kneading and baking In early KS2 pupils should also know: • that a healthy diet is made up from a variety and balance of different food and drink, as depicted in The eatwell plate • that to be active and healthy, food and drink are needed to provide energy for the body In late KS2 pupils should also know: • *that recipes can be adapted to change the appearance, taste, texture and aroma* • that different food and drink contain different substances – nutrients, water and fibre – that are needed for health

KS1 Imaginary and story-based contexts

Commentary:
Careful selection of contexts for children's learning is essential if they are to work confidently. Imaginary and story-based contexts, whilst not included as examples in the 2014 programme of study for KS1, can provide real, relevant and motivating starting points for children's designing and making. Traditional stories, fairy tales or nursery rhymes with a design problem to be solved can provide appropriate contexts for children's designing and making. Where appropriate, imaginary and story-based contexts can be linked to cross-curricular topics or themes or connect with learning in other subjects.

Examples of classroom practice:

- *Children in Y2 are given the problem of designing and making a hat to stop Teddy getting sunburnt in the summer.*
- *Children in Y1 are challenged to design and make a stronger, more stable chair for Baby Bear using construction materials, construction kits and textiles.*

Other examples of projects carried out within imaginary or story-based contexts include:

- Designing and making a trolley to carry the Teddy bears' picnic to the park
- Designing and making vehicles for Bob the Builder
- Designing and making a coat for Katie the class doll
- Designing and making a Shaun the Sheep storyboard with moving pictures
- Designing and making a new bridge for Billy Goats Gruff
- Designing and making a safety jacket that helps Teddy to be seen at night

KS1 Local community, industry and the wider environment

Commentary:
Choosing suitable contexts for children's learning is essential if they are to work confidently. It is important to carefully select contexts based on the local community, industry and the wider environment that are meaningful and relevant to KS1 children's learning. Where appropriate, these contexts can be linked to cross-curricular topics or themes or connect with learning in other subjects.

Examples of classroom practice:

- *After a class visit to the local park, children in Y2 are given the challenge of turning the park into a playground by designing and making small-scale freestanding play equipment suitable for young children.*
- *Following a visit to the local library, Y1 children design and make books with flaps and sliders that can be displayed and read in the school library.*
- *Following a visit to the local farm, Y2 children are inspired to design and make a range of toy farm vehicles suitable for the children in Nursery and Reception to play with.*

Other examples of projects carried out within the context of the local community, industry or the wider environment include:

- Designing and making fruit drinks for a local supermarket following a class visit
- Designing and making a small-scale carnival float for the local parade
- Designing and making toy emergency service vehicles after a visit by the fire brigade
- Designing and making toy enclosures for farm animals after a visit to a local farm
- Designing and making small-scale park furniture after a visit to the local park
- Designing and making greeting cards with simple moving parts to put on sale in the class shop

KS1 Themselves or other users

Commentary:
Children should think about and be able to say who the products they design and make will be for. Given their early stage of development, the users for KS1 children's products will often be themselves. Other users should be familiar to the children, including imaginary or story-based characters, younger children, their peers or parents, so that the children are able to undertake a real evaluation. As children progress, the range of users can become less familiar, for example visitors to the school or people they meet in the local community during class visits.

Examples of classroom practice:

- *Children in Y1 design and make finger and glove puppets to use themselves in their classroom theatre.*
- *As part of their topic 'Moving Along' children in Y2 are given the challenge of designing and making a vehicle for Bob the Builder that performs a specific task he needs to carry out.*
- *Children in Y2 design and make a whole class moving picture book of popular nursery rhymes for the children in Reception to enjoy.*

Other examples of users include:

- Teddy bear – design and make a trolley to carry his picnic to the park
- Katie the class doll – design and make a cape for her to wear when it is cold
- Parents and carers – design and make greetings cards for them with simple moving parts for a special occasion
- Shoppers – design and make a new range of fruit drinks that they could purchase from a local supermarket

KS1 What their products are for

Commentary:
Children should be able to clearly state the purpose of their products. The products children design and make at KS1 should perform clearly defined tasks and should be evaluated in use.

Examples of classroom practice:

- *Designing and making fruit salads for sports day*
- *Designing and making vegetable kebabs for the class picnic*
- *Designing and making a poster with moving parts for a class display*
- *Designing and making a vehicle to solve a problem for a story character*
- *Designing and making a fabric placemat to protect surfaces*
- *Designing and making a finger puppet for imaginary role-play*

KS1 How their products will work

Commentary:
Children should think about and be able to clearly state how their products will work. Every product should have a functional element. The functionality of products children design and make at KS1 should help to fulfil users' needs and purposes. When children explain how their products work there will often be a link to their knowledge and understanding in science.

Examples of children's voice:

- *'A slider moves backwards and forwards and I can use this in my picture to make the snail move forwards and backwards from behind a stone.'*
- *'I am going to use running stitch to join my glove puppet together as it is stronger than glue or lacing.'*
- *'I have put more bricks at the bottom of my tower to make the bottom wider so it doesn't fall over.'*
- *'Thick card is strong so I will use it to make the seat for Baby Bear.'*

KS1 Simple design criteria

Commentary:
Children should use a limited number of simple design criteria to help develop their ideas. In KS1 design criteria might be provided by the class teacher to guide children's thinking, generated through a class discussion or developed by the children themselves. The criteria should state what the product has to do in order to be successful and children should refer to them to help inform their design ideas.

Examples of classroom practice:

- *The fruit salad should be sweet, colourful and crunchy.*
- *The bag should be the right size, strong and easy to carry.*
- *The mechanism should make the mouse go smoothly in and out of the hole.*
- *The structure should stand up on its own and be strong enough to carry Teddy.*

KS1 Drawing on their own experiences

Commentary:
Children should generate ideas by drawing on their own experiences. This is an important step in building on children's previous learning and utilising their experience of D&T in the home and community. KS1 children are surrounded by products in the designed and made world and should be encouraged to talk about products they have seen and used as a basis for generating their own design ideas. Where appropriate, children could also bring to school examples of the products they use at home.

Example questions to elicit children's experiences and help to generate ideas:

- *What types of fruit have you eaten? Which is your favourite fruit and why?*
- *Have you played with any puppets before? How did you use them? What were they made from? Why do you think these materials were used?*
- *What types of toy vehicles have you played with? How do they work? What kind of games do you play with them?*
- *Have you built a tower before? What construction kit did you use? How did you stop it from falling over?*

KS1 Use knowledge of existing products

Commentary:
When children in KS1 are generating ideas it is good practice for these to be informed by existing products they have explored and evaluated. This draws together National Curriculum requirements for designing and evaluating in a coherent way that makes sense to children and reflects D&T in the wider world. The range of existing products, such as handling collections, made available to children should be chosen carefully to support them in generating ideas for their own products. The main methodology for learning about existing products is questioning – by both the teacher and the children. Effective questioning extends the children's thinking.

Examples of questions for exploring and evaluating a range of existing products at KS1 include:

- *What are the products called?*
- *Who are the products for?*
- *What are the products for?*
- *How are the products used?*
- *How do the products work?*
- *Where might the products be used?*
- *What materials are the products made from? Why have these been used?*
- *What do you like and dislike about the products?*
- *What change/s would you make to the product to make it more appealing to you?*

KS1 Talking and drawing

Commentary:
Talking and drawing provide two very important ways for KS1 children to develop and communicate their ideas.

a) Talking
Spoken language is fundamental to the development and communication of design ideas. At KS1 children can use spoken language to imagine possibilities, explain and evaluate their ideas, build technical vocabulary appropriate to the product they are designing and making, and listen to what others have to say. Examples of relevant questions that children might ask to guide their thinking include:

- *How could we make the ….?*
- *What materials could we use?*
- *What will it look like?*
- *What size, colour, shape, taste, texture ….?*
- *How will it work?*
- *What would happen if ….?*
- *How can we make it stronger?*

b) Drawing
Children should use simple drawings to support their designing with the inclusion of labels to identify materials, components and parts of their products. Careful teacher judgment should be applied in KS1 when using drawing as a technique for designing. Initially children can find it difficult to develop and communicate their ideas through drawings. In such circumstances, it is good practice to develop this technique retrospectively by drawing their products when they have been completed. As children make progress, drawing can then be used prospectively to develop and communicate their ideas.

KS1 Exploring materials, components and construction kits

Commentary:
Children in KS1 should 'model' ideas by exploring materials, components and construction kits. In this context 'modelling' refers to representing thoughts in some way in order to generate, develop, communicate, evaluate and modify ideas for products. Materials and components can be temporarily arranged and rearranged to find out whether a design idea will work in reality. Similarly, models built with construction kits can be used to externalise children's design ideas in a form that can be discussed and evaluated prior to using consumable materials and components.

Example of practice:
Nigella enjoyed looking at the different toy vehicles on display. After watching a Bob the Builder video, she talked about making a model of a London bus that Bob could ride on a day trip to the capital. Nigella looked at different wheels and body shapes in the collection of toy vehicles, and used construction kits to make models of different buses. She then collected materials and components that could be used to make her final product and arranged them, without fixing them together permanently, to see if her ideas would actually work.

KS1 Making templates and mock-ups

Commentary:
KS1 children should 'model' their ideas by making templates and mock-ups. In this context 'modelling' refers to representing thoughts in some way in order to generate, develop, communicate, evaluate and modify ideas for products. Creating templates enables children to represent the shape and size of their product in a way that also assists with measuring and marking out of the final product. Mock-ups are generally 3-D representations of design ideas. They enable children to try out their ideas quickly using simple, temporary joining techniques and inexpensive materials.

Examples of practice:

- *Using a paper template to develop ideas and mark out the fabric needed for a finger puppet or glove puppet.*
- *Using paper or dipryl and masking tape to mock-up and evaluate ideas for a beach bag prior to using more expensive materials and permanent joining techniques.*

KS1 Use information and communication technology

Commentary:
Children at KS1 should use information and communication technology (ICT), where appropriate, to develop and communicate their ideas. It is appropriate to use ICT in KS1:

- When children can see the value of using it e.g. it improves the accuracy and appearance of their final product
- Where it achieves learning objectives within a particular project more effectively or efficiently e.g. it helps children to develop their design ideas more rapidly
- Where children have been taught and have practised the skills they need to use the software successfully and independently

Examples include:

- *Children use generic paint software to design a coat for Teddy.*
- *Children use simulation software to model and assemble a structure on the computer screen by clicking, dragging and assembling components from a virtual construction kit.*

KS1 Suggesting what to do next

Commentary:
Most children in KS1 should be able to suggest what to do next in assembling their products.

Examples of next steps might include:

- *Deciding who they will work with*
- *Choosing where to work*
- *Saying what material or component they need to collect first*
- *Deciding which tool or piece of equipment is needed for a particular task*
- *Saying which practical skill or technique (e.g. sawing or gluing) will be used*
- *Deciding which finishing media to use*
- *Taking a closer look at some existing products*

KS1 Select from a range of tools and equipment

Commentary:
Children in KS1 should be able to select from a range of tools and equipment and explain their choices. As they progress they should be able to do this with increasing independence. Some of the tools and equipment children select will be suitable for their task. Other selections may not and will require teacher intervention and guidance as appropriate.

Examples of what children might do:

- *Jacinta correctly identified the tools she needed to make axle rods for her vehicle, including a small vice pre-attached to a work station in the classroom and a junior hacksaw. She could explain that the vice held the dowel securely whist it was sawn using the junior hacksaw.*
- *Marcel independently identified and selected the utensils he needed to make his fruit salad. He could explain that that kitchen scissors could be used to cut some herbs and a juicer used to squeeze juice from an orange.*

KS1 Select from a range of materials and components

Commentary:
Children in KS1 should be able to select from a range of materials and components according to their characteristics. As they progress they should be able to do this with increasing independence. The explanations children give should refer to either functional properties (i.e. strong or waterproof) or aesthetic qualities (e.g. shiny or patterned) or both. Some of the materials and components children select will be suitable for their task. Other selections may not and will require teacher intervention and guidance as appropriate.

Examples of what children might say and do:

- *Yoshe looked at the collection of fruit displayed in the classroom. He was able to name most of the fruit and identified some of the sensory characteristics (e.g. appearance, taste) that would make them suitable for his fruit kebab. He used his knowledge of these characteristics when selecting from the range provided by his teacher.*
- *Maia selected fabrics and components to make a safety jacket for Teddy. She could explain that she had chosen some fabric because it was reflective and would help Teddy to be seen at night and other fabric to keep him warm. She chose to use Velcro as her fastener as it made it easy for Teddy to take the jacket on and off.*

KS1 Measure, mark out, cut and shape

Commentary:
Children in KS1 should be able to measure, mark out, cut and shape a range of materials and components including food ingredients, mechanical components, textiles and construction materials.

Examples at KS1 include:

- *Making a template and using it to mark out a piece of fabric*
- *Measuring the required length of dowel with non-standard or standard units and marking out before cutting*
- *Slicing vegetables with a serrated, round ended knife*
- *Making holes using an appropriate hole punch*
- *Using a junior hacksaw to cut dowel*
- *Folding paper and card*

KS1 Assemble, join and combine

Commentary:
Children in KS1 should be able to assemble, join and combine a range of materials and components including food ingredients, mechanical components, textiles and construction materials.

Examples at KS1 include:

- *Assembling construction kit components to build a freestanding framework*
- *Making a mock-up by joining paper with masking tape*
- *Using paper fasteners as pivots in a simple lever*
- *Combining ingredients with a dressing to make a vegetable salad*
- *Combining wooden wheels and axles in a toy vehicle*

KS1 Use finishing techniques

Commentary:
Children in KS1 should be able to use finishing techniques with a range of materials and components including food ingredients, mechanical components, textiles and construction materials.

Examples at KS1 include:

- *Using digital text and graphics to enhance a moving picture*
- *Using paint to make small-scale playground equipment appealing to the intended users*
- *Using glasspaper to finish rough edges where wood has been sawn*
- *Adding sequins to a coat for Kinga the class doll*
- *Applying 3-D fabric paint or printing to a simple bag*
- *Using paper finishing techniques to bring pictures to life in books and cards*

KS1 Talk about their design ideas and what they are making

Spoken language is the main way that KS1 children reflect upon and evaluate their design ideas and products.

a) Talking about design ideas

When considering their design ideas, children should refer to what their product is intended to do, who it will be for and how it will work. This will involve children asking and answering questions such as:

- *What type of product will I make?*
- *Who will the product be for?*
- *What will my product do?*
- *How will my product work?*
- *Where will my product be used?*
- *What materials and components will I use?*
- *What do I like about my design ideas?*
- *Will my design ideas meet the design criteria?*
- *What idea has my design buddy given me that might help to improve my design?*

b) Talking about their products

When considering their products, children should be able to say what they are intended to do, who they will be for and how they will work. This will involve children asking and answering questions such as:

- *How well does the product meet the needs of the user?*
- *How well does the product achieve its purpose?*
- *How well does it work?*
- *What do I like about my product?*
- *How well does my product match the design criteria?*
- *What could I do to make it better?*
- *What one thing would I tell other children to help them when designing?*

KS1 Make simple judgements

Commentary:
Throughout the designing and making process, children in KS1 should make simple judgements about their products and ideas against design criteria. Design criteria might be provided by the class teacher to guide children's thinking, generated through a class discussion or developed by the children themselves. The criteria should state what the product has to do in order to be successful and children should refer to them when evaluating their design ideas and products.

Examples of classroom practice:

- *The fruit salad should be sweet, colourful and crunchy.*
- *The bag should be the right size, strong, easy to carry.*
- *The moving part in the picture should move in and out and it should move smoothly.*
- *The structure should stand up on its own and be strong enough to carry Teddy.*

KS1 Simple working characteristics

Commentary:
Drawing on their science understanding where appropriate, KS1 children should know about the simple working characteristics of a range of materials and components including food ingredients, mechanical components, textiles and construction materials. This knowledge should be applied when children are selecting materials and components for their products. Children should refer to either functional properties (i.e. strong or waterproof) or aesthetic qualities (e.g. shiny or patterned) or both.

Examples of what children might say and do:

- *Xavier looked at the collection of fruit displayed in the classroom. He was able to name most of the fruit and identified some of the sensory characteristics (e.g. appearance, taste) that would make them suitable for his fruit kebab. He used his knowledge of these characteristics when selecting from the range provided by his teacher.*
- *Maia selected fabric and components to make a safety jacket for Teddy. She could explain that she had chosen some fabric because it was reflective and would help Teddy to be seen at night and other fabric to keep him warm. She chose to use Velcro as her fastener as it made it easy for Teddy to take the jacket on and off.*

KS1 Movement of simple mechanisms

Commentary:
Drawing on their previous and everyday experiences of things that move, KS1 children should know that simple mechanisms produce different types of movement. Simple mechanisms include sliders which move in a straight line, levers which move in a curve and wheels and axles which turn. Children may also learn about simple winding mechanisms. This knowledge should be applied when children are deciding which type of mechanism they need to create the type of movement they want in their products. For example, a simple card lever could be used to show a butterfly flying to a flower and a slider used to show a snail appearing from behind a stone. In KS1 the expectation is that most children will control mechanisms directly e.g. push or pull a toy vehicle they have designed and made.

Teacher questioning can help to develop children's knowledge and understanding.

Existing products:
- *What parts of the picture do you think will move?*
- *What parts of the vehicle do you think will move?*
- *How do you make the mechanism move?*
- *What is the mechanism called?*
- *What type of movement does the mechanism make?*

Own products:
- *What parts of your picture will move?*
- *How do you want them to move?*
- *What type of mechanism do you need for the …?*
- *Where will you put the slot for the slider? Where will you put the pivot for the lever?*
- *Will the wheels on your vehicle be fixed or loose on the axle? Why?*
- *Where will you put the axle holders so the vehicle will run in a straight line?*

KS1 Stronger, stiffer and more stable

Commentary:
Children in KS1 should know how freestanding structures can be made stronger, stiffer and more stable. Freestanding structures can be assembled using construction kits to help develop children's understanding and include walls, buttresses, towers and frameworks. They can also fold paper and card to create simple structures, making joins with masking tape where necessary, to explore the concepts of strength, stiffness and stability. This understanding should be applied when children are designing and making products. Construction kits can be used in combination with consumable materials to assemble children's final products.

Teacher questioning can help to develop children's knowledge and understanding.

Existing products:

- *What are the structures called?*
- *What materials have been chosen and why?*
- *How have the parts been joined together?*
- *How have the structures been made stable?*
- *How have they been made strong enough or stiff enough for their purpose?*

Own products:

- *How will you make your structure stand up on its own?*
- *How will you make it stable?*
- *How will you make it strong enough for its purpose?*
- *How will you make it stiff enough for its purpose?*
- *What materials or construction kits will you use? Why?*
- *How will you join the parts of your structure together?*

KS1 Two identical fabric shapes

Commentary:
Children in KS1 should understand that a 3-D textiles product can be assembled from two identical fabric shapes. This understanding should be applied when they are designing and making products. Children should create templates and use these to mark out and cut identical fabric shapes. Some children may progress to use simple pattern pieces. Fabric shapes can be joined together using a variety of techniques, such as simple running stitch, gluing, stapling and lacing. Techniques should be demonstrated by the teacher and then practised, explored and evaluated by the children, with adult supervision as appropriate.

Examples of what children might say and do:

- *Skylar decided to make an animal glove puppet as a prop to use when retelling one of her favourite stories. Her teacher demonstrated how to mark and cut out identical fabric shapes using a card template and Skylar made a simple finger puppet with glue and felt in order to practise the technique. Her teacher then demonstrated a range of joining techniques including sewing, lacing and stapling. Skylar practised each technique through a focused task and decided to use sewing for her glove puppet as she felt it was strongest. She drew around her hand and used this as a basis for her card template. She could explain why the card template needed to be 1cm wider around its perimeter to provide seam allowance.*
- *Tareek decided to make a simple placemat for Teddy to protect the table from his dinner plate. His teacher demonstrated how to use plastic shapes as templates and how to mark out and cut identical fabric shapes. Tareek practised this technique and applied it to make his placemat which he assembled using two pieces of patterned fabric glued together, with wadding in between. He found this project straightforward and made rapid progress, so his teacher asked him to design and make something for Teddy. Tareek chose to assemble a felt bag using a simple pattern piece and Velcro as a fastening.*

KS1 Combined according to their sensory characteristics

Commentary:
Children in KS1 should know that food ingredients can be combined according to their sensory characteristics. The sensory characteristics of ingredients are appearance, taste (flavour), texture (mouth feel) and smell (aroma). Children should select the ingredients they wish combine in a food product according to these characteristics in order to meet design criteria and the preferences of the person or people who will consume it. In effective practice, the sensory descriptors children use for each of these characteristics should be supplemented by a word bank in order to develop their sensory vocabulary.

An example of practice:
Jordan tasted and looked closely at a variety of types of fruit. He described and recorded the colour, taste and smell of each type of fruit and, when supported by his teacher, used words to describe texture. He decided that he wanted his fruit salad for a class party to be colourful, sweet and crunchy and used these design criteria to select from the range of ingredients provided by his teacher.

Children's voice when selecting ingredients:

- *'I want my fruit yogurt to be orange, sour and smooth.'*
- *'I want my fruit kebab to be green, yellow and red, juicy, soft and smell fresh.'*

KS1 Five groups in *The eatwell plate*

Commentary:
In KS1 children should be able to name and sort foods into the five groups from The eatwell plate. They should know that a healthy diet comprises food and drinks from each of the food groups:

- Fruit and vegetables;
- Bread, rice, potatoes, pasta and other starchy foods;
- Milk and dairy foods;
- Meat, fish, eggs, beans and other non-dairy sources of protein;
- Foods and drinks high in fat and/or sugar.

Examples of activities to develop children's knowledge and understanding at KS1:

- *Naming different foods*
- *Discussing what foods might be in each group*
- *Sorting foods into the correct food groups*
- *Identifying the largest groups*
- *Identifying the smallest group*
- *Discussing what this means for the food products children design and make*

KS1 Five portions of fruit and vegetables every day

Commentary:
Children in KS1 should know that everyone should eat at least five portions of fruit and vegetables every day. A portion is what fits into the palm of a hand. Variety is important and different types of fruit and vegetables count, for example:

- fresh, e.g. tomatoes
- frozen, e.g. frozen peas
- dried, e.g. raisins
- canned, e.g. sweetcorn or carrots
- juice, e.g. orange juice

KS1 Cutting, peeling and grating

Commentary:
KS1 children should learn how to use skills and techniques such as cutting, peeling and grating. It is important that children understand that we need certain skills and techniques to be able to make food products. In KS1 these might include washing, peeling, juicing, grating and cutting (e.g. snipping herbs and spring onions with kitchen scissors suitable for children's use). These skills and techniques should be demonstrated correctly and safely to the children by a teacher or another trained adult.

Examples of practice:

- *Ingredients for chopping and slicing are cut in half lengthways to provide a flat base and held still with a fork so that children are able to cut safely.*
- *Using carrots, children explore the effects of using different equipment on the same ingredient when grating, slicing into thin rings and slicing into sticks.*
- *Children think about the effects of different utensils on fruit and vegetables e.g. the juicer is used to make juice from an orange.*

KS2 Purpose of their products

Commentary:
Across KS2 children should be able to describe, in some detail, the purpose of the products they are designing and making. There will be a variety of purposes of their products during the key stage.

Examples of classroom practice:
Designing and making packaging to protect and market fragile objects that are on sale
Designing and making healthy, seasonal soup recipes that the school cook could make for lunch
Designing and making bird hides to observe wildlife in the school garden
Designing and making an attractive display with moving parts for a shop window

The purpose of children's products should be clearly reflected in the design criteria they generate at the beginning of projects and should be at the forefront of their thinking during the designing and making process. Children's descriptions of the purpose of their products should go beyond the statements they make at KS1 and can be prompted through a variety of related questions such as:

- *What is your product for?*
- *What task or tasks will your product perform?*
- *How will your product solve the design problem?*
- *How will your product meet the design challenge?*
- *How will you make your product fit for purpose?*
- *Will your product have to fulfil conflicting requirements? If so, what are they and how will you overcome them?*
- *Where will your product be used?*
- *When will your product be used?*
- *How well do you think your product will meet its intended purpose?*

KS2 Appeal to intended users

Commentary:
Across KS2 children should indicate the design features of their products that will appeal to intended users. This expectation builds on saying whether their products are for themselves or other users in KS1. In KS2 children should be able to explain how specific aspects of their design ideas or products will meet users' needs, wants and preferences.

For example:

- *Designing and making a personalised bag for a teenager – considering the appearance and finishing techniques used*
- *Designing and making savoury scones for grandparents – considering taste, texture, aroma and ingredients used*
- *Designing and making a desk tidy for younger children – considering cost, size, shape, weight and strength*

Children should be able to say:

- *How the user will interact with the product e.g. using fasteners, compartments, switches or mechanical components*
- *How the product is suited to the interests of the intended user e.g. takes account of their hobbies and pastimes*

As they progress through KS2, the users of children's products should become wide ranging, for example older people, people with special dietary needs, businesses, members of staff in school and consumers from a variety of cultures.

KS2 How parts of their products work

Commentary:
Across KS2, children should be able to explain how particular parts of their products work. This builds on the expectation in KS1 that children say how their products will work, requiring a more detailed explanation.

Children's voice:

- *'When you push or pull the slider it causes the lever to move and this makes the dog's tail wag.'*
- *'The pulley attached to the motor spindle makes the elastic band rotate and this makes the pulley on the axle rotate.'*
- *'I have reinforced the base of the sports bag with corrugated plastic.'*
- *'The triangles used in the framework for my bird hide make it a strong structure.'*
- *'When I turn the switch to the left it completes the circuit and my nightlight comes on.'*

Early KS2 Gathering information

Commentary:
In early KS2 children should gather information about the needs and wants of particular individuals and groups. This process should help children to generate ideas and inform the design decisions they make about the products they create. Gathering information can be prompted by a range of questions, for example:

- *What do the intended users need?*
- *What do the users want?*
- *Do the users have any particular interests or hobbies?*
- *Do the users have any particular dietary requirements?*
- *What is the age of the intended users?*
- *What do we know about the users' everyday lives?*
- *What sorts of products do users already find helpful?*
- *What can we do to make the users' lives better?*

Early KS2 Own design criteria

Commentary:
In early KS2 children should develop their own design criteria and use these to inform their ideas, referring to them as they design and make. This builds on using simple design criteria in KS1.

Children should generate several design criteria to help develop their ideas. In early KS2, whilst design criteria might initially be modelled by the class teacher or generated through a class discussion, children should ultimately formulate design criteria themselves. The criteria should state what their product has to do in order to be successful. In some instances it may be helpful for children to put them into an order of priority.

Examples of classroom practice:

- *The nightlight should be freestanding, provide a soft light, be easy to switch on and off, and interesting for the user.*
- *The souvenir money container should be the appealing to visitors to the museum shop, carry loose coins, be easy to carry and securely fastened.*
- *The packaging should protect the biscuits inside, be made from recyclable materials and be easy to open and close.*
- *The moving greetings card should be entertaining to look at, easy to use, make use of a lever and linkage mechanism that suits the picture, and work reliably.*

Late KS2 Carry out research

Commentary:
Children in late KS2 should carry out research, using surveys, interviews, questionnaires and web-based resources. Building on activities where they gather information in early KS2, children's research should be more extensive, using a variety of strategies to help identify the needs, wants, preferences and values of particular individuals and groups, and secondary sources to find out about existing products that cannot be explored through first-hand experience. Research should inform the design decisions that children make.

Examples of practice:

- *Children in Year 5 use a questionnaire to discover the favourite soups of all children in the school before designing and making a seasonal soup for the school cook to prepare and serve at lunchtime.*
- *Using relevant websites, Year 6 children research different bread recipes from a range of cultures and countries as a basis for their own designing and making.*
- *To inform their designing and making, Year 5 children investigate and make annotated sketches of a range of portable and permanent frame structures, e.g. tents, bus shelters, umbrellas. To find out about a wider range of products that use frameworks, they use secondary sources, including web-based research.*
- *Before designing and making a new, small-scale fairground ride, Year 6 children use the internet and CD-ROMs to carry out research into the most popular rides, why they might appeal to intended users and the type of movement they produce.*

Late KS2 Simple design specification

Commentary:
Building on work in early KS2 where children use their own design criteria, children in late KS2 should develop a simple design specification to guide their thinking when designing and making. They should also evaluate their ideas and products against their design specification. A simple design specification should include, but go beyond, design criteria to provide a more detailed statement or bullet pointed list in response to a design brief, challenge or opportunity e.g. who the intended user is, what the purpose of the product is, information about the requirements for the product and how the product is to be assembled. The design specification may be negotiated and agreed between the pupil, as designer, and his or her client or end user.

Questions to prompt the development of a design specification:

- *What will be the purpose or purposes of the product?*
- *Who is the intended user?*
- *What design features should the product include in order to meet user needs and wants?*
- *What safety or environmental requirements will it have to meet?*
- *How much should it cost to make?*
- *Are there any constraints that need to be followed e.g. using recycled fabrics only?*
- *What types of materials and components will the product made from?*
- *What shape, size, weight and colour will it need to be?*
- *What design criteria will it have to meet if it is to be successful?*

KS2 Prototypes and pattern pieces

Commentary:
Whilst continuing to carry out activities from KS1 where they are making templates and mock-ups, across KS2 children should also 'model' their ideas by using prototypes and pattern pieces.

a) Pattern pieces
Typically, paper pattern pieces are used in projects were children are designing and making textile products to ensure that the fabric shapes cut out are the correct size and shape, and to encourage the economical use of materials. Children should be able to join a pattern, made from grid or tracing paper, onto fabric. They should be able to minimise wastage, and know how to leave a seam allowance.

Examples include:
- *In Y3/4, designing and making pattern pieces for pencil cases, story sacks or purses where a single fabric shape is used to create a 3-D textiles product.*
- *In Y5/6, designing and making pattern pieces for hats and bags where several fabric shapes are combined to make the final product.*

b) Prototypes
Prototypes are built by children in KS2 in order to test and evaluate the form and function of their design ideas in three dimensions, before going on to create the final product.

Examples include:
- *In Y3/4, developing prototypes from re-cycled card to develop, model and communicate their ideas for the moving parts in a greetings card.*
- *In Y5/6, using a construction kit to build a working prototype for a toy fairground ride intended for younger children.*

KS2 Annotated sketches, cross-sectional drawings and exploded diagrams

Commentary:
Across KS2, children should use annotated sketches, cross-sectional drawings and exploded diagrams to help develop and communicate their design ideas. This builds on the drawings children use in KS1. The type of drawing technique used in KS2 will depend on the nature of the product being created. Annotated sketches are helpful where details of a pupil's design are most effectively explained through notes. Cross-sectional diagrams enable children to show what their product will look like inside. Exploded diagrams help children to show which components they intend to construct their products from and the order of assembly. As children progress through KS2, they should be able to select the type of drawing technique best suited to the product they are designing.

Examples of practice:

- *Using an annotated sketch to explain the various features of a beach bag e.g. how it is held, where equipment and clothing are stored, how it is fastened.*
- *Using a cross-sectional drawing to show the parts and components in a torch e.g. outer casing, reflector, lens, bulb, battery and switch.*
- *Using an exploded diagram to show the mechanical components and structural parts of a battery-powered toy vehicle and their order of assembly e.g. wheel, pulley, axle, axle holder, chassis and body.*

KS2 Computer-aided design

Commentary:
Across KS2, computer-aided design (CAD) should be used, where appropriate, to develop, communicate, model and evaluate design ideas. This builds on activities where children use information and communication technology in KS1. In KS2 children gain experience of using specialist CAD software. This enables them to draw objects accurately to size, use the idea of scale, make accurate measurements and manipulate objects (e.g. move, copy, resize). CAD should be used where children see the value of using it because it enables them to develop their design ideas more efficiently or effectively.

Examples include:

- *Designing an accurate net for packaging, including text and graphics. This may be printed out onto card, cut out and assembled to achieve the final product. This also provides a simple introduction to computer-aided manufacture (CAM).*
- *Using pattern making software to print out and mock-up the parts for a textiles product e.g. hat, bag, apron.*
- *Using simulation software to model and assemble the parts of a construction kit by clicking, dragging, arranging and re-arranging components on the computer screen.*

Early KS2 Generate realistic ideas

Commentary:
In early KS2, children should be taught how to generate ideas that are realistic and which meet the needs of the user. In doing so, they should consider the availability of resources and time, and their own level of practical expertise. They will also need to consider how products can be made fit for purpose.

Example of practice:

- *Poppy generated ideas for battery-powered night lights, taking into account the electrical components and other materials available in the classroom. She appreciated that her final product should remain stable on a bedside cabinet, should be easily operated and should be built using the knowledge and skills at her disposal.*

Late KS2 Generate innovative ideas

Commentary:
Whilst continuing to generate realistic design ideas, in late KS2 children should also be encouraged to be increasingly innovative. In practice children can demonstrate innovation by showing some originality with their thinking, introducing some unusual or new elements into the products they are designing and making, whilst ensuring that final outcomes are fully functional and fit for purpose.

Example of practice:

- *When designing and making containers using recycled textiles, Kieran developed and responded to his own design brief of creating a belt bag suitable for gardeners, generating ideas for a product that would meet specific user needs and fulfil a number of purposes. His completed product was imaginative, functional and appealing, having some ingenious design features.*

KS2 Select tools and equipment suitable for the task

Commentary:
Building on their experience in KS1, across KS2 children should be able to select tools and equipment suitable for the task. The key word in this expectation is 'suitable' and children should make selections that are appropriately matched to the skills and techniques they will be using.

Examples of what children might do:

- *Ricardo chose a ruler, try square, junior hacksaw, jointing jig and bench hook to measure, mark out, cut and join pieces of square section wood to create the framework for his moving toy. He lightly finished the sawn ends of the wood with glasspaper, and used PVA glue with card triangles to make strong, right-angled joints.*
- *When building her battery-powered electrical board game, Yasmin selected automatic wire strippers and a screwdriver to make secure connections between electrical components and wire. She used the wire strippers to remove the insulation from the wire and to cut it to length, and used the screwdriver to attach wire to the screw connections on bulb holders.*

KS2 Select materials and components suitable for the task

Commentary:
Building on their experience in KS1, across KS2 children should be able to select materials and components suitable for the task. The key word in this expectation is 'suitable' and children should make selections that are appropriately matched to the skills and techniques they will be using.

Examples of children's voice:

- *'I chose a 1.5v battery to match the 1.5v bulb in the circuit for my illuminated sign.' Krystal*
- *'I decided to use a gear with 10 teeth for the motor spindle and 50 teeth on the axle so that the vehicle would travel slowly.' Sophie*
- *'I chose to use some denim for the bottom piece of my bag as it is strong and hard wearing.' Jin*
- *'I decided to add some basil to my summer soup recipe to give it more colour and flavour.' Jodie*

Early KS2 Some accuracy

Commentary:
In early KS2 children should demonstrate 'some accuracy' when they are measuring, marking out, cutting, shaping, assembling, joining, combining and applying finishing techniques. The expectation of using 'some accuracy' applies to all the materials and components they are working with. The amount of accuracy children are able to achieve will be reflected in the quality of the finish of the final product, how successfully the product works, how appealing the product is to the intended user, how well it meets their needs and how effectively it achieves its intended purpose.

Examples of practice:

- *When designing and making packaging for biscuits in Y4, Yarnee was able to use centimetres to carefully measure and mark out the net for her packaging. Her cutting, joining and folding skills showed a reasonable level of accuracy, leading to a strong package that was able to successfully contain and protect biscuits.*
- *When designing and making coleslaw for a summer picnic, Andrew showed well-developed fine motor skills when grating, peeling, chopping, slicing fruit and vegetables. The ingredients in the final product were of a similar size and shape, and the dish was well presented and finished.*
- *When designing and making a lever and linkage mechanism for a class display, Samantha measured the length of the card strips to the nearest half centimetre, carefully marked out where she wanted the pivots to go and used scissors effectively to cut paper and card. The resulting mechanism worked smoothly and reliably, and ensured that her moving picture was appealing to other members of the class.*

Late KS2 Accurately

Commentary:
In late KS2 children should work 'accurately' when they are measuring, marking out, cutting, shaping, assembling, joining, combining and applying finishing techniques. This is a higher level of expectation than in early KS2 where most children will be working with some accuracy. The expectation of working accurately applies to all the materials and components children are using. The amount of accuracy children are able to achieve will be reflected in the quality of the finish of the final product, how successfully the product works, how appealing the product is to the intended user, how well it meets their needs and how effectively it achieves its intended purpose.

Examples of practice:

- *Sarah and Sven worked together to design and make a cam toy for younger children. They were able to measure, double check and cut all components and materials to the millimetre to ensure an accurate alignment between the cams and the followers, and a smooth operation of the toy. They were mindful throughout the project of the need to produce a good quality finish to make the toy attractive and amusing for their intended users.*
- *Sophie and Aisha designed and made a small-scale bird hide. Using a 1:10 scale they accurately measured square section wood for the framework with millimetres, used a try square to mark the wood, held it securely in a bench hook and skilfully used a junior hacksaw to make a precise cut. When joining the wood together they used PVA glue sparingly to ensure a good quality finish.*
- *Elizabeth and Luca worked together very conscientiously and with high levels of concentration when designing and making a battery-powered toy vehicle. They were especially mindful to ensure that the gear on the motor spindle meshed exactly with the gear on the axle and trialled the position of the motor several times before attaching it to the chassis in the correct position. The also invested time in carefully stripping and cutting wire, assembling a handmade switch and making secure electrical connections to ensure the reliability of the completed product.*

KS2 Inventors, designers, engineers, chefs and manufacturers

Commentary:
Across KS2 pupils should learn about inventors, designers, engineers, chefs and manufacturers who have developed ground-breaking products. They should know who a range of inventors are, what they are famous for designing and/or making and what characteristics enabled them to become successful. The range of people and products that children consider should cover the range of aspects of D&T they will be working in i.e. mechanical and electrical systems, structures, textiles and food. Children may study the development of a product over time (e.g. electric torch); the product or products invented by a single person (e.g. Edison) or consider products that relate to a single aspect of D&T (e.g. textiles – Velcro).

Examples of practice:

- *Linked to their work in history, when children were designing and making hats in Y5 they researched and learnt about significant people in their locality and further afield linked to textiles e.g. William Morris.*
- *When designing and making frame-based products in Y6, children researched related key events and individuals such as Stephen Sauvestre – a designer of the Eiffel Tower and Thomas Farnolls Pritchard – designer of the Iron Bridge.*
- *When designing and making a lighting system, Y5/6 children used a timeline to learn about the development of electric torches and lamps, and researched famous inventors related to their project e.g. Thomas Edison – light bulb.*

KS2 Functional properties and aesthetic qualities

Commentary:
Across KS2, children should be able to explain their choice of materials and components according to functional properties and aesthetic qualities. Unlike KS1, where children should select from a range of materials and components according to their characteristics, in KS2 children should distinguish between the physical or functional properties of materials that enable products to work effectively and the aesthetic qualities of materials that give products their appearance, texture and, where appropriate, taste and aroma.

Examples of practice:

- *When designing and making a sandwich wrap, children chose ingredients that would appeal to their intended users by considering taste, texture, appearance and aroma, and thought about how the ingredients would contribute to a healthy and varied diet by making selections from the food groups illustrated in The eatwell plate.*
- *When designing and making battery-powered nightlights, children used their science understanding of translucent, transparent and opaque materials to make appropriate selections for the shade of their products, whilst choosing finishing media and materials to appeal to their intended users.*

KS2 Input, process and output

Commentary:
Children should think about the related components that make up mechanical systems, for example the levers, linkages and pivots in a moving picture. They should also think about the input movement used to operate the mechanism, the output movement produced by the mechanism and the process – how the mechanism changes the input movement into the output movement.

Children should think about the related components that make up electrical systems, for example the switch, bulb and batteries. They should also think about what type of input device, for example a toggle switch or push-to-make switch, they will use to control their product and what output device will be operated, for example a bulb or buzzer.

Examples of practice:

- *Madison could explain how her personalised battery-powered nightlight worked as an electrical system. She could identify all the parts that were used in her product, say which component was the input device and which component was the output device.*
- *Thomas could identify all the mechanical components within his battery-powered toy vehicle. He could explain the process of how the input movement of the motor spindle led to the output movement of the wheels, including the way in which two pulleys linked by an elastic band reduced the rate of rotation.*

Early KS2 Control their products

Commentary:
In early KS2 children should know how to program a computer to control products they have designed and made. This can be achieved with a programmable micro-controller, a stand-alone computer control box or an interface box connected to a computer. Their computing knowledge and skills should focus on physically controlling 'output' devices, such as bulbs, buzzers, electric motors and light emitting diodes (LEDs). They learn to use text or create a flowchart to control a single device by turning it on and off according to a set of instructions. This can be developed by children controlling more than one output device at the same time, such as a bulb and a buzzer, with two programs running simultaneously. The idea of an 'endless loop' should also be introduced so that sequences of instructions can be repeated.
N.B. In the primary classroom, light emitting diodes (LEDs) with internal resistors should be used.

Examples of practice:

- *Designing and making a nightlight in Y3 that is programmed to automatically switch off after a set period of time, when a child has gone to sleep.*
- *Designing and making an illuminated flashing sign in Y4 that is programmed to operate in response to a repeating sequence of instructions.*

Early KS2 Shell structures

Commentary:
Children in early KS2 should learn how to make strong, stiff shell structures and use this knowledge to design and make products. A shell structure has an outer skin to provide strength (e.g. packaging) whilst a frame structure (e.g. tent frame) is constructed using an arrangement of thin components. Children should learn about the factors that can increase the strength and stiffness of shell structures, such as the properties of the material from which it is made, its shape and whether it has been reinforced in any way.

Examples of products children could design and make that require an understanding of shell structures in early KS2 include:

- *gift boxes/containers*
- *desk tidy*
- *disposable/recyclable lunchboxes*
- *packaging*
- *cool boxes*
- *party boxes*
- *keep safe boxes*
- *mystery boxes*

KS2 Create movement

Commentary:
In KS2, children should build on their understanding of the movement of simple mechanisms in KS1. In early KS2, children know how mechanical systems such as levers and linkages or pneumatic systems create movement. In late KS2, children know how mechanical systems such as cams or pulleys or gears create movement. Children should be able to explain why the mechanical components are suitable for the product they are designing and making according to the type of movement they produce.

Across KS2, children should develop and apply the correct technical vocabulary to describe the movement of mechanical systems:

- *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*

Late KS2 How to program a computer to monitor changes in the environment

Commentary:
In late KS2 children should know how to program a computer to monitor changes in the environment and control their products. This builds on the expectation that children will control their products in early KS2. In late KS2, children need to develop an understanding of 'monitoring' as well as control and the idea of 'input' as well as 'output'. Children's learning should focus on using input devices such as switches and sensors. They learn that it is possible to connect input devices such as light dependant resistors (LDRs), reed switches, push-to-make switches, pressure pads and toggle switches to an interface box or programmable micro-controller. Children then control and monitor electrical products they have designed and made.

Example of practice:
When designing and making a burglar alarm, Y5/6 children use commercially produced push-to-make switches, micro-switches and reed switches as input devices connected to a buzzer. Through class discussion, children see the need for a delay between the alarm being activated and the buzzer going off to give time for the system to be switched off. Children connect the switches used in their alarm system to the interface box as input devices and connect a buzzer (with a compatible voltage) as an output device. They then create a sequence of instructions so that when the alarm is activated there is a pause before the buzzer goes off.

KS2 Peeling, chopping, slicing, grating, mixing, spreading, kneading and baking

Commentary:
Across KS2 children should learn how to use skills and techniques such as peeling, chopping, slicing, grating, mixing, spreading, kneading and baking. Children should learn that in addition to the basic food skills which enabled them to prepare simple products in KS1 (see cutting, peeling and grating), there are many other food skills and techniques which enable them to extend the number of products they can design and make. These should be demonstrated correctly and safely to the children by a teacher or another trained adult.

Examples of practice:

- *In early KS2, when designing and making fillings for bread-based products, children use peeling, chopping, slicing, grating and spreading techniques, and tools such as round-ended knives, vegetable peelers, apple corers, strawberry hullers and graters.*
- *In late KS2, when designing and making a range of savoury, baked products, children use mixing to combine ingredients, rubbing-in to mix fat and flour and kneading when working with bread dough.*

Early KS2 Variety and balance in The eatwell plate

Commentary:
Building on their previous experience in KS1, early KS2 children should know that we need to eat a variety and balance of food and drinks to stay healthy, as depicted in The eatwell plate:

- Fruit and vegetables;
- Bread, rice, potatoes, pasta and other starchy foods;
- Milk and dairy foods;
- Meat, fish, eggs, beans and other non-dairy sources of protein;
- Foods and drinks high in fat and/or sugar.

Examples of what children should know and understand in KS2:

- *Revisiting learning from KS1 that there are five main food groups in The eatwell plate*
- *Food products are sometimes made from two or more of these food groups*
- *The eatwell plate shows us the proportions of different food groups we should eat, e.g. compared to the other food groups, we should eat more fruit and vegetables and bread, rice, potatoes, pasta and other starchy foods*