Key Knowledge:

Prior learning:

Explored and used mechanisms such as flaps, sliders and levers. (look at Y1 Moving pictures – levers and sliders teaching notes). Gained experience of basic cutting, joining and finishing techniques with paper and card.

- To know how investigate a range of 3-D textile products relevant to the project.
- To know how to investigate and evaluate products with lever and linkages mechanisms, in order to learn how they function
- To know how to express likes and dislikes of the designs
- To know how to relate the way things work to their intended purpose
- To know how to use appropriate technical vocabulary to describe materials and mechanisms
- To know how to develop, model and communicate their ideas through drawings and mock-ups with card and paper.
- To know how to explore and use sliders and levers.
- To know how to understand that different mechanisms produce different types of movement.
- To know how to apply appropriate cutting and shaping techniques that include cuts within the perimeter of the material (slots and cut outs)
- To know how to use scientific knowledge about the transfer of forces in levers
- To know and use technical vocabulary relevant to the project.
- To know how to generate realistic ideas and their own design criteria through discussion, focusing on the needs of the user.
- To know how to explore, develop and communicate aspects of their design proposals by modelling their ideas in a variety of ways
- To know how to develop a clear idea of what has to be done, planning how to use materials, equipment and processes
- To know how to plan by suggesting what to do next.
- To know how to select from and use appropriate tools with some accuracy to cut, shape and join paper and card.
- To know how to select from and use finishing techniques suitable for the product they are creating.
- To know how to evaluate their design ideas as these develop, indicating ways of improving their ideas and to evaluate the book against the original design criteria.
- To know how to consider others views.

Lesson Sequence:

What are levers and linkages? • Children investigate, analyse and evaluate books and, where available, other products which have a range of lever and linkage mechanisms. Use questions to develop children's understanding. • Discuss the processes used to decorate the cover and pages of the books, identifying the simplicity or complexity of the designs. • Discuss the wording, layout and style of the text used on the cover and throughout the books. • Discuss what they like and dislike and the effect the moving mechanisms have. • Introduce the vocabulary and use it in these discussions.	Key Questions: • Who might it be for? • What is its purpose? • What do you think will move? • How will you make it move? • What part moved and how did it move? • How do you think the mechanism works? • What materials have been used? • How are the parts joined together? • How effective do you think it is and why? • What else could move? • What is the direction of the movement?

How can I create levers and linkages?

Moving on:

- Demonstrate a range of lever and linkage mechanisms to the children using prepared teaching aids. (See Teaching notes)
- Demonstrate the correct and accurate use of measuring, marking out, cutting, joining and finishing skills and techniques including slots and cut outs.
- Children should develop their knowledge and skills by replicating one or more of the teaching aids.
- 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.

In **year 1** Moving pictures – levers and sliders children should have been shown how to :-

- Make a glue tab
- Fold card neatly
- Make a hinge to create moving parts
- Use a split pin to join card to make a pivot
- To make a pop up
- To make a v fold
- Have paper fasteners, card, card strips, small paper trimmer, glue sticks available for children to explore and use freely.

Safety- Children should be shown how to poke holes in card safely using blu tac and a pencil and hole punchers

Key Questions:

- How will you make it move?
- What else could move in the product?
- How well does it work?
- Which card strip is the lever?
- Which card strip is acting as the linkage?
- Which part of the system is the input and which part the output?
- What does the type of movement remind you of?
- Which are the fixed pivots and which are the loose pivots?

Can I create a design criteria?

- Develop a design brief with the children within a context which is authentic and meaningful. A perfect example is to make a book for World book Day or a moving puppet character from a story. The outcome could be to use it to enhance a story reading for a younger sibling or year group at school.
- Discuss with children the purpose of the products they will be designing and making and who the products will be for. Ask the children to generate a range of ideas, encouraging creative responses. Agree on design criteria that can be used to guide the development and evaluation of the children's products.

Key Questions:

- What does your page need to be like?

Can I design a story with moving creatures?

Explain to the children that their task is to:

- Design and make a storybook with moving parts. The pages of the book are to incorporate mechanisms eg pop-up, sliding parts and linkages. Ask the children to think carefully about the type of book they might make. See questions. The children will need to decide how many pages their book will have, and how the pages and cover are to be assembled.
- Get the children to talk through their designs with a Teacher, peer or TA and listen to their feedback.
- Children will create prototype moving arts for their stories and sitck them in project booklets.

Key Questions:

- Who will use it?
- What will be the storyline?
- Why will moving parts be useful in the story?
- What type of mechanisms may be included?
- Which are the fixed pivots and which are the loose pivots?
- Which part of the system is the input and which part the output?
- What character will you choose? Why?
- What moving parts will they have? Arms, wings, legs? Why have you chosen that part? What will it add to the story?

Can I make a story with moving creatures?

- The big project should be a small book of their own (this could be a well known story like 'Little Red Riding Hood' or from a class text in another subject that the children are familiar with)
- Children should follow the safety guidelines given and be able to select their own coloured or plain card.
- After a reminder of the methods to make each mechanism the majority should be able to execute their design independently. Make sure blu tac is available for safely poking holes in card.
- Children should be encouraged to identify what is and what is not working well in their books and what makes a quality finish.
- Discuss the finishing techniques the children might use e.g. using digital text and graphics, paint, felt tipped pens or collage.

Key Questions:

- The big project should be a page for a class or group book, a small book of their own or a moving character.
- Children should follow the safety guidelines given and be able to select their own coloured or plain card.
- After a reminder of the methods to make each mechanism the majority should be able to execute their design independently. Make sure blu tac is available for safely poking holes in card.
- Children should be encouraged to identify what is and what is not working well in their books and what makes a quality finish.
- Does it look appealing?
- Will you paint it or colour it?
- Could you draw some on the computer to print out?

How can I test and evaluate by product?

- Ask children to evaluate their developing ideas and final products against the original design criteria.
- Evaluate the books in use, highlighting strengths and discussing improvements that could be made. Ask them to compare their products with commercially made ones.
- The children should test out each other's books and give constructive feedback.

Key Questions:

- Did it turn out as you wanted?
- How could you improve?
- What did other people think?

Year 4

Levers & Linkages Crawling Creature books

Our Rainbow

Encourage **R**esilience and perseverance
Develop **A**rticulate learners
Influence aspirations
Nurture curiosity
Instil **B**ritish and Christian Values
Provide **O**pportunities to build upon knowledge and skills
Promote **W**ellbeing and Health

Unit sequence:

Evaluating existing products
Tinkering activites (practical tasks)
Design criteria
Design and planning
Making
Finishing
Testing and follow up
Evaluating

Design, make and evaluate a (product) for (user) for (purpose)

Suggested starting points:

What could they design and make?

Pop up story book, poster, class display, greetings card, information book, storyboard, moving animal puppet

Intended user: Themselves, younger children, parents, grandparents, friends, visitors to school.

Purpose: Celebration event, information, pleasure, interests, hobbies, educational.

Resources

A collection of books which have pop-up and moving parts other products which include linkages eg toys, squeezy kitchen mops, examples of pop-up and moving mechanisms made beforehand, squared paper, coloured paper and card, paper fasteners or binders, paper straws, PVA glue, glue sticks, masking tape, thick corrugated card and drawing pins for modelling ideas, scissors, small paper trimmer, hole punch.

Real work links

Engineering
Programme designer
Celebrations
Reading - World Book Day
Science animals

National Curriculum Coverage

Key stage 2

Through a variety of creative and practical activities, pupils should be taught the knowledge, understanding and skills needed to engage in an iterative process of designing and making. They should work in a range of relevant contexts [for example, the home, school, leisure, culture, enterprise, industry and the wider environment].

When designing and making, pupils should be taught to:

Design

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

Make

select from and use a wider range of tools and equipment to perform practical tasks [for example, cutting, shaping, joining and finishing], accurately
select from and use a wider range of materials and components, including construction materials, textiles and ingredients, according to their functional properties and aesthetic qualities

Evaluate

investigate and analyse a range of existing products
evaluate their ideas and products against their own design criteria and consider the views of others to improve their work
understand how key events and individuals in design and technology have helped shape the world

Technical knowledge

apply their understanding of how to strengthen, stiffen and reinforce more complex structures
understand and use mechanical systems in their products [for example, gears, pulleys, cams, levers and linkages]
understand and use electrical systems in their products [for example, series circuits incorporating switches, bulbs, buzzers and motors]
apply their understanding of computing to program, monitor and control their products

Health and Safety

- The children should be shown the safe use of any tools they have access to and any that are in the room.
- Glue guns are not needed but at KS1 glue guns should be used by the teacher or under direct supervision.
- You can pre-cut the axles or get the children to use a junior hacksaw to cut the dowel themselves.
- Hacksaws at KS1 should be under small group supervision. This will depend on the experience and maturity of the children.

R	Using Growth mindset and embracing challenging practical skills
A	Explaining verbally what they like and dislike about existing products
I	Real life links
N	Exploring products with levers/linkages and their purposes. Each lesson lead with a question.
B	
O	Knowledge of levers and linkages and cutting and joining techniques.
W	Health and Safety links.

Vital Vocabulary

Linkage	Lever	Pivot	Rotary
Mecanism	Oscilating	Textiles	Prototype