

1. Year Groups
Years
3/4

2. Aspect of D&T
Mechanical
systems

Focus
Levers and
linkages

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

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

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

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

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

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

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

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

lever and linkage
teaching aids

system, input, process,
output
linear, rotary, oscillating,
reciprocating
user, purpose, function

3. Key learning in design and technology

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

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

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

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

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

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

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

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

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

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

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

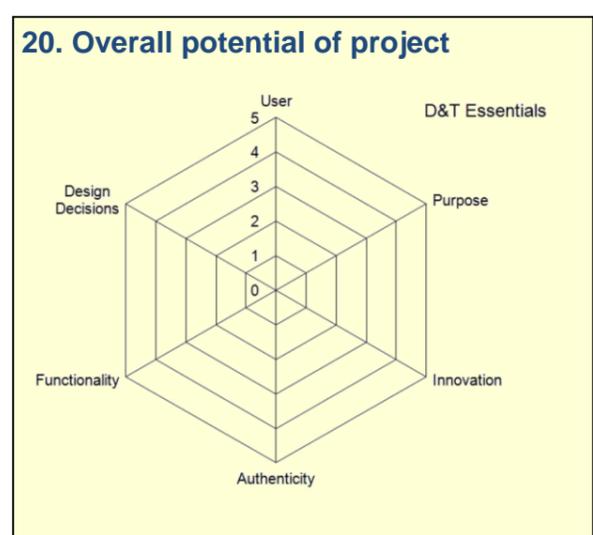
card strips, card
rectangles, paper,
masking tape, paper
fasteners, paper binders,
stick glue

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

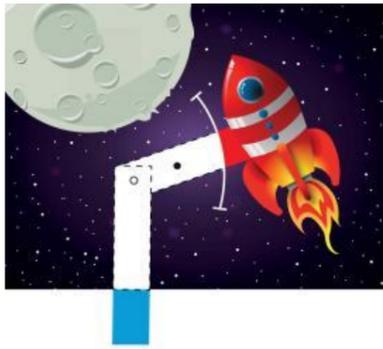
prototype, design criteria,
innovative, appealing,
design brief

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

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



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 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 'Let's Get Practical!' Support Pack
- D&T Primary 17 issue on mechanisms including levers and linkages
- CPD Resources Primary Inset Guides

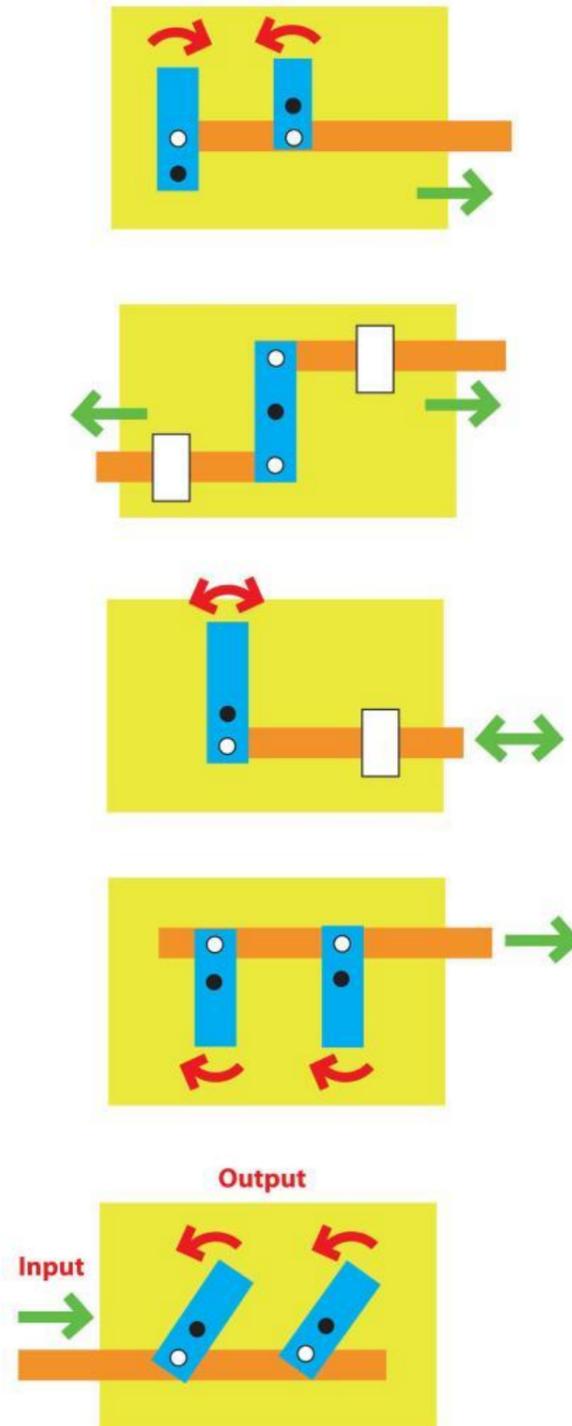
D&T Association publications:

- Primary Helpsheets - Unit 4B Storybooks
- Primary Lesson Plans - Unit 4B Storybooks

Please note that these publications are based on previous National Curricula.

Teaching aids to demonstrate levers and linkages

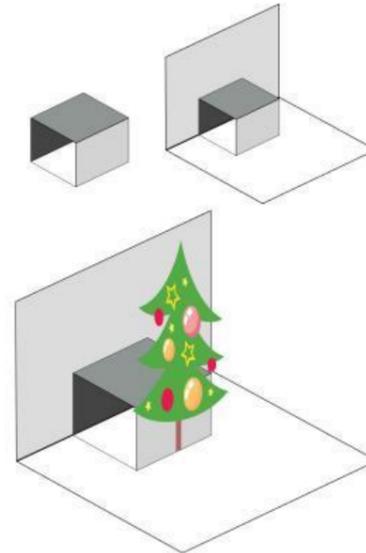
- Fixed pivot
- Loose pivot



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

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

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



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

Lever and linkage mechanisms usually produce oscillating or reciprocating movement:

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

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

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

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

Glossary

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