
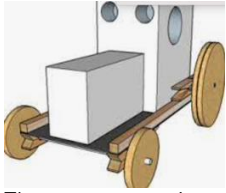
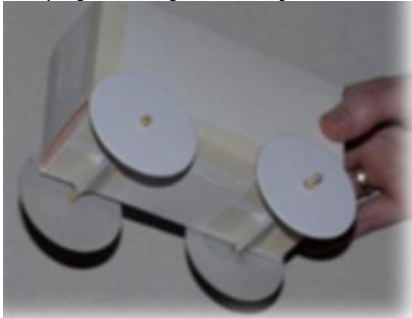
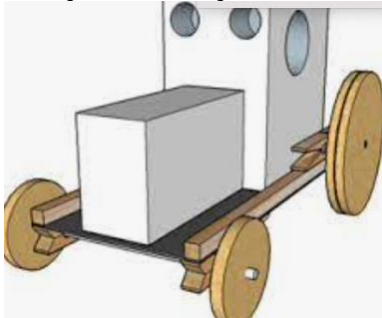




Year Group: 2	Term: Spring 2 2022	Teacher: Sarah Bride	Subject lead: Catherine O'Neill Edwards	Overview: Mechanisms – Wheels and Axles Design, make and evaluate a wheeled vehicle	Key End Points: By the end of this unit children will be able to: - Know what an axle is - Know the difference between a fixed and a free moving axle - can create a working axle	
Links to other learning: Maths: measurements Art: range of mediums	Relevant Prior Learning: - Experience of using wheeled vehicles	Future Learning: - mechanisms taught in every year group. Y3 – levers and linkages	High Quality Text: <i>'The Story of the Easter Bunny'</i> Katherine Tegen	Risk Assessment: - Dowels may need sawing – teacher to risk assess if this should be done by adults. See DT lead to ensure know how to use a bench hook and saw correctly - Take care when putting holes through a box see https://www.youtube.com/watch?v=bsordXVQUQ0	Teacher CPD: Please read the DATA project on a page sheets attached at the end of this plan prior to teaching.	
<u>Learning Intention</u>	<u>Lesson Outline (Key Questions in colour)</u>			<u>Resources</u>	<u>Vocabulary</u>	<u>Lowest 20% Adaptations</u>
I know what an axle is	<p>This is a DT lesson. In DT we design and make to solve problems. This week our job is to help the easter bunny and we are going to design, make and evaluate a wheeled vehicle – but who is our user? Who will the vehicle be for? Read <i>'The Story of the Easter Bunny'</i> by Katherine Tegen to the class. Look at illustration on the front cover (and any on the inside) and point out the Easter Bunny's cart – their cart is broken and they need your help to make a new Easter cart. To help us, we are going to investigate some wheeled vehicles. What is a vehicle? Something used for moving people or objects. Give children two minutes to try and think of as many vehicles as possible <i>e.g. car, train, bus, pram, wheelchair, helicopter, trolley, boat, aeroplane</i> or go around class and see if each child can give a different vehicle without repeating a already given answer. We are going to take a closer look at wheeled vehicles today – vehicles that have wheels.</p> <p>Investigative and Evaluative Activities (IEAs)</p> <ul style="list-style-type: none"> • Explore and evaluate a range of wheeled products such as toys and everyday objects. Through questioning, direct children's observations e.g. the number, size, position of wheels. <i>How do you think the wheels move? How do you think the wheels are fixed on? Why do you think the product has this number of wheels? Why do you think the wheels are round?</i> <p>We need some more information to make sure we are using the correct vocabulary. We are going to learn how wheels work. Our key word for today is axle. An axle is a rod that allows wheels to move. What is an axle? A rod that makes wheels work. Repeat three times in different voices and throughout the lesson.</p> <p>Explain other vocabulary for children to use during discussion:</p> <ul style="list-style-type: none"> Axle – a rod that allows wheels to move Body – the main part of the vehicle (that the chassis is attached to) Chassis – the frame that supports a vehicle (example here  Wheel – a circular object that works with an axle to move Axle holder – the part of the chassis that an axle fits through <p>Encourage children to look again at the wheeled toys using the vocabulary above and locating the parts</p>			Range of toy wheeled vehicles  This image printed to go in each child's book to label books	Axle Axle holder Wheel Chassis Body Vehicle	

	<ul style="list-style-type: none"> • Display the image on the left and label together as a class using the vocabulary as above   <ul style="list-style-type: none"> • In books, children label the picture on the right using the words: axle, body, chassis, wheel, axle holder: • Walk around the school building and grounds, recording how wheels and axles are used in daily life. <p>Exit Pass: Children record design brief in books (product, user, purpose) e.g. I am making a wheeled vehicle/cart for the easter bunny to carry eggs.</p>			
<p>I can make a working axle.</p> <p>I can explain if an axle is loose or free</p>	<p>This is a DT lesson. In DT we design and make to solve problems.</p> <p>Recap on prior learning: What is an axle? A rod that makes wheels work. Discuss what these words mean: Body, Chassis, Wheel, Axle holder</p> <p>Focused Tasks (FTs)</p> <p>There are two main types of Axle: fixed axle and free axle – add to learning wall. Demonstrate to children how wheels and axles may be assembled as either fixed axles or free axles. A fixed axle is when the axle is fixed and does not spin. Demonstrate this by creating a real version of a fixed axle in front of the children, thinking aloud and explaining as you go. This dowel is my axle. I am taping a dowel rod to the bottom of a box. This means the rod/axle will not spin. If the axle will not spin, we need to make sure the wheels do spin – this means the hole in the middle of the wheel needs to be bigger than the axle. Show cotton reels fit easily on to a dowel rod and spin easily. I now need to stop the wheels coming off the axle – use either balls of blue tack, rubber bands or wrapping tape around the axle. Let's test to see if my fixed axle works... does it move along the floor?</p> <p>I am now going to show you a free axle. I need the axle to spin so I need the hole that it goes through to be bigger than the axle. Use either a wide paper/plastic straw or clothes peg taped to the bottom of the box (see CPD sheet at end of MTP) ensuring this is wider than the dowel. This is the axle holder – it is wider than the axle so the axle will spin. Put the dowel in and show the axle spinning. Because the axle spins, I need to make sure the wheels are fixed on to the axle and they don't spin (we don't want the wheels and the axle to both spin), a wooden wheel would be a tight fit on to the dowel axle. Test to check it works</p> <ul style="list-style-type: none"> • Revisit vehicle and toys from yesterday's lesson – sort items into fixed and free axles • Using samples of materials and components they will use when designing and making, ask the children to assemble some examples of free and fixed axles <p>Encourage discussion – is it working? If not, why not? By the end of the lesson each child need to be able to make a working axle and identify if it is a fixed or free axle. Photograph the children's working models</p> <p>In books children record which type of axle they wish to use in their books and explain why.</p>	<p>Toy wheeled vehicles from yesterday</p> <p>Wooden wheels</p> <p>Card wheels</p> <p>Cotton reels</p> <p>Dowel</p> <p>Straws</p> <p>Spring clothes pegs</p> <p>Card board</p> <p>Blue tack</p> <p>Pritt stick</p> <p>Sellotape</p> <p>Masking tape</p> <p>Carboard boxes/junk boxes</p>	<p>Fixed axle</p> <p>Free axle</p> <p>Axle</p> <p>Axle holder</p> <p>Spin</p> <p>rotate</p>	<p>Scribe for children who find writing difficult</p> <p>Physical support for children who struggle with fine motor skills</p>

I can design my product	<p>This is a DT lesson. In DT we design and make to solve problems.</p> <p>Recap on prior learning: What is an axle? A rod that makes wheels work. Discuss what these words mean: Body, Chassis, Wheel, Axle holder. What is our design brief? What is the product, who is the user, what is the purpose?</p> <ul style="list-style-type: none"> • Ask children to generate, develop and communicate their ideas as appropriate through talk and drawing. Talk about, evaluate and share ideas with other children/adults. Children draw their product design. Encourage children to draw the vehicle as a whole and then a more detailed drawing of the axle and how it will work. Children label drawings. (demonstrate the two different drawing in the board if clarification is needed). Why do we draw our design and not just write about what we want our design to look like? Encourage children to talk about what they will need and record in books • Discuss how the children might add finishing techniques to their product e.g. paint, glitter, pictures of easter eggs, felt tips, fabric, pom poms, chocolate wrappers. Children record finishing techniques in books. 	Books	Design Draw Finishing techniques	
I can make my product following my design	<p>This is a DT lesson. In DT we design and make to solve problems.</p> <p>Today we are gong to manufacture our product. This means we are going to make it. Children make their product according to their design (have designs out for children to refer to).</p> <p>Should you follow your design? What is something does not work? Would you still follow your plan? Explain that children should follow their plan, however if something does not work then they should make changes as they go. They can record this at the end in their evaluation. This activity may span more than one afternoon – ensure the children have enough time to complete this activity and they are not rushed. Photograph each individual product close up to go in books</p>	Wooden wheels Card wheels Cotton reels Dowel Straws Spring clothes pegs Card board Blue tack Pritt stick Sellotape Masking tape Carboard boxes/junk boxes Items for various finishing techniques as planned by children e.g. paint, glitter, pom poms, chocolate wrappers	Manufacture Make product	
I can test and evaluate my product	<p>This is a DT lesson. In DT we design and make to solve problems.</p> <p>Today we are going to test our products. There are two things we need to do to test it:</p> <ol style="list-style-type: none"> 1) Make sure the axle and wheels work 2) Make sure it carries Easter eggs <p>Children test if the vehicle moves and if the axles and wheels work effectively. Give out chocolate eggs and test to see if they stay in the vehicle. In DT we design and make to solve problems. To make sure we solve problems in the best way we evaluate our work to say what went well and what could be even better. Encourage discussion and recording of the following questions giving explanations using the word because:</p> <p>Did you use fixed or free axles? Do the wheels and axles work? Does the vehicle carry eggs? Does the product look like your design? Do you like the finishing technique? What is the best thing about your product? What would you change? What was the most difficult part? What would you score your product out of 5?</p>		Evaluate	

1. Year Groups
Year 1/2

2. Aspect of D&T
Mechanisms

Focus
Wheels and axles

4. What could children design, make and evaluate?
push/pull toys e.g. emergency service vehicle
carnival float farm vehicle clown's car
vehicle for imaginary/story character
shopping trolley other – specify

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

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

16. Possible resources
selection of toy vehicles with differently fixed axles

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

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

17. Key vocabulary
vehicle, wheel, axle, axle holder, chassis, body, cab

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

names of tools, equipment and materials used

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

3. Key learning in design and technology

Prior learning

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

Designing

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

Making

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

Evaluating

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

Technical knowledge and understanding

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

7. Links to topics/themes
People Who Help Us Helping Others
Our Local Community Food and Farming
Traditional Stories Fairy Tales Transport
Nursery Rhymes Toys other – specify

8. Possible contexts
imaginary story-based home school
leisure culture local community
other – specify

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

10. Investigative and Evaluative Activities (IEAs)

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

11. Related learning in other subjects

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

12. Focused Tasks (FTs)

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

13. Related learning in other subjects

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

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

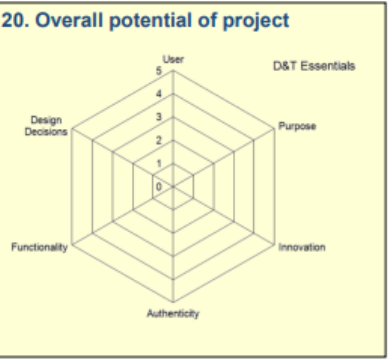
19. Health and safety
Pupils should be taught to work safely, using tools, equipment, materials, components and techniques appropriate to the task. Risk assessments should be carried out prior to undertaking this project.

14. Design, Make and Evaluate Assignment (DMEA)

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

15. Related learning in other subjects

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



Years 1/2

Mechanisms Wheels and axles

Instant CPD



Tips for teachers

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

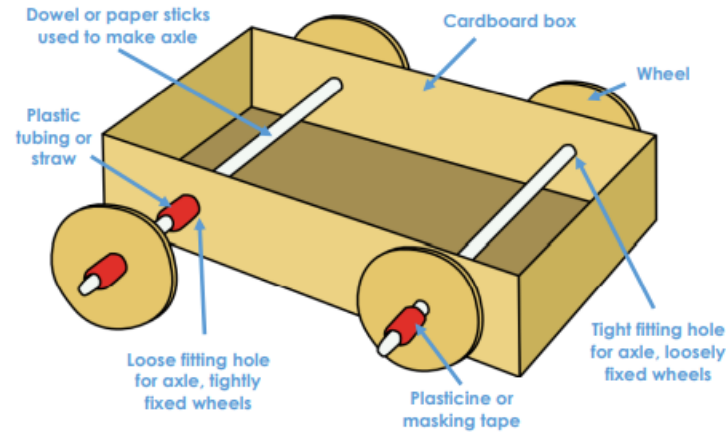
Useful resources at www.data.org.uk

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

EYFS Resources

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

Two different ways to fix wheels



Types of wheels



Ways to hold moving axles

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



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



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



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

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

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

Glossary

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