

1. Year Groups
Years
5/6

2. Aspect of D&T Structures

Focus
Frame structures

3. Key learning in design and technology

Prior learning

- Experience of using measuring, marking out, cutting, joining, shaping and finishing techniques with construction materials.
- Basic understanding of what structures are and how they can be made stronger, stiffer and more stable.

Designing

- Carry out research into user needs and existing products, using surveys, interviews, questionnaires and web-based resources.
- Develop a simple design specification to guide the development of their ideas and products, taking account of constraints including time, resources and cost.
- Generate, develop and model innovative ideas, through discussion, prototypes and annotated sketches.

Making

- Formulate a clear plan, including a step-by-step list of what needs to be done and lists of resources to be used.
- Competently select from and use appropriate tools to accurately measure, mark out, cut, shape and join construction materials to make frameworks.
- Use finishing and decorative techniques suitable for the product they are designing and making.

Evaluating

- Investigate and evaluate a range of existing frame structures.
- Critically evaluate their products against their design specification, intended user and purpose, identifying strengths and areas for development, and carrying out appropriate tests.
- Research key events and individuals relevant to frame structures.

Technical knowledge and understanding

- Understand how to strengthen, stiffen and reinforce 3-D frameworks.
- Know and use technical vocabulary relevant to the project.

4. What could children design, make and evaluate?

playground shelter market stall bus shelter tent play house gazebo bird hide parasol park furniture adventure playground equipment kite other – specify

7. Links to topics and themes

Shape and Space Festivals Celebrations Our School Toys and Games Outdoors Our Local Community Weather Countries and Cultures other – specify

5. Intended users

themselves parents younger/older children local community walkers market trader gardeners mountaineers bird watchers other – specify

8. Possible contexts

home school gardens leisure culture local community wider environment other – specify

6. Purpose of products

safety weather protection play pleasure meeting place business recreation 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)

- Children investigate and make annotated drawings of a range of portable and permanent frame structures, e.g. tents, bus shelters, umbrellas. Use photographs and web-based research to extend the range e.g. *How well does the frame structure meet users' needs and purposes? Why were materials chosen? What methods of construction have been used? How has the framework been strengthened, reinforced and stiffened? How does the shape of the framework affect its strength? How innovative is the design? When was it made? Who made it? Where was it made?*
- Children could research key events and individuals related to their study of frame structures e.g. Stephen Sauvestre – a designer of the Eiffel Tower; Thomas Farnolls Pritchard – designer of the Iron Bridge. They could also learn about locally important design and technology activity related to their project.

12. Focused Tasks (FTs)

- Use a construction kit consisting of plastic strips and paper fasteners to build 2-D frameworks. Compare the strength of square frameworks with triangular frameworks. Ask the children to reinforce square frameworks using diagonals to help develop an understanding of using triangulation to add strength to a structure.
- Demonstrate how paper tubes can be made from rolling sheets of newspaper diagonally around pieces of e.g. dowel. Ask children to use these tubes and masking tape or paper straws with pipe cleaners to build 3-D frameworks such as cubes, cuboids and pyramids. *How could each of the frameworks be reinforced and strengthened?*
- Demonstrate the accurate use of tools and equipment. Develop skills and techniques using junior hacksaws, G-clamps, bench hooks, square section wood, card triangles and hand drills to construct wooden frames, as appropriate.
- Demonstrate skills and techniques for accurately joining framework materials together e.g. paper straws, square sectioned wood. Ask children to practise these, mounting their joints onto card for future reference.

14. Design, Make and Evaluate Assignment (DMEA)

- Discuss the brief of designing and making a small-scale frame structure e.g. *Who is the intended user and what is the purpose of the frame structure? Will it be permanent, or can it be easily dismantled? What materials will you use? How will it be joined? How will it be reinforced? How will it be finished?* Children should be encouraged to generate innovative ideas, drawing on their research. Ask children to develop a simple design specification to guide their thinking.
- Children should produce a detailed, step-by-step plan, listing tools and materials.
- Children's sketches should be annotated with notes to help develop and communicate their ideas.
- Encourage children to model their ideas first using materials such as paper, card and paper straws e.g. *How will you make it stable? How will it stand up? How could you make it stronger? Where are the weak points? How could you reinforce them? What tools and materials will you need? How can you improve the design?*
- Encourage children to make their products with accuracy. They should regularly evaluate their work and their completed product, drawing on their design specification, and thinking about the intended purpose and user.

11. Related learning in other subjects

- **Science** – compare and group together everyday materials on the basis of their properties.
- **Mathematics** – identify 3-D shapes, including cubes and other cuboids, from 2-D representations.
- **Spoken language** – ask relevant questions, formulate and express opinions, give well-structured descriptions and explanations. Use relevant strategies to build their vocabulary.
- **Computing** – use technologies for research purposes and be discerning when evaluating digital content.

13. Related learning in other subjects

- **Mathematics** – recognise, describe and build simple 3-D shapes. Apply understanding and skill to carry out accurate measuring using standard units i.e. cm/mm.
- **Spoken language** – ask relevant questions, formulate and express opinions, give well-structured descriptions and explanations. Use strategies to build their vocabulary.

15. Related learning in other subjects

- **Spoken language** – ask relevant questions, formulate and express opinions, give well-structured descriptions and explanations. Use strategies to build their vocabulary.
- **Art and design** – use and develop drawing skills.
- **Mathematics** – apply understanding and skill to carry out accurate measuring using standard units i.e. cm/mm.

16. Possible resources

products, photographs, web-based resources of existing frame structures

card, paper straws, newspaper, square sectioned wood, masking tape, PVA glue pencils, rulers, right/left handed scissors, bench hooks, G-clamp, junior hacksaws, glass paper

finishing media and materials

17. Key vocabulary

frame structure, stiffen, strengthen, reinforce, triangulation, stability, shape, join, temporary, permanent

design brief, design specification, prototype, annotated sketch, purpose, user, innovation, research, functional

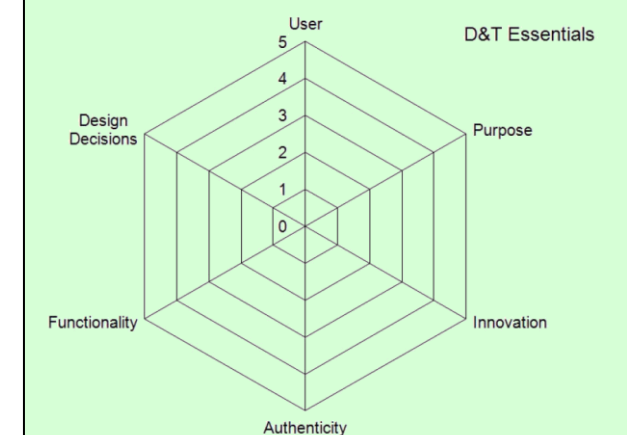
18. Key competencies

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.

20. Overall potential of project



Instant CPD



Tips for teachers

- ✓ Collect a range of photographs of different frame structures, both portable and permanent e.g. tents, bus shelters, bird hides.
- ✓ Include examples constructed with external and internal frameworks.
- ✓ Record the process of investigating frame structures using photographs and annotated drawings.
- ✓ Take children on a local 'frame structures' trail to help them get ideas for their own products and understand construction techniques.
- ✓ Frame structures for large scale shelters can be made from broom sticks, garden canes or rolls of newspaper.
- ✓ Ensure children are familiar with all the materials they are likely to use and that these are made easily available and accessible.
- ✓ Discuss constraints such as time, resources and cost.
- ✓ Display technical vocabulary and encourage children to use it when discussing, designing and making their product.
- ✓ Ensure children use simple tests to evaluate the functionality and strength of their products.
- ✓ Encourage the children to evaluate each other's work positively.

Useful resources at www.data.org.uk:

- Bird Hides Dragons' Den Challenge
- Let's Get Practical poster: Working with paper straws
- CPD Resources Primary Inset Guides

Other useful web-based resources:

- <http://education.staffordshire.gov.uk/Curriculum/Subjectareas/DesignandTechnology/Primary/Support/Datafile/>

D&T Association publications:

- Primary Helpsheets - Unit 6A Shelters
- Primary Lesson Plans - Unit 6A Shelters

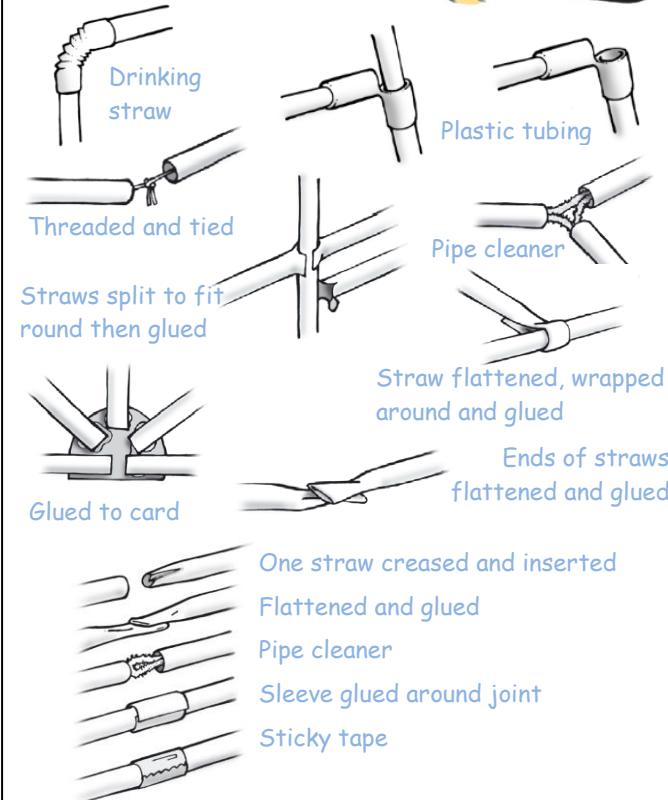
Please note that these publications are based on previous National Curricula.

Techniques for building frame structures

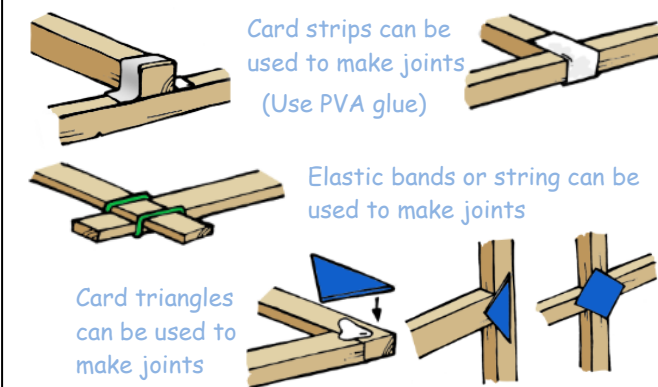
Roll paper to make tubes for construction



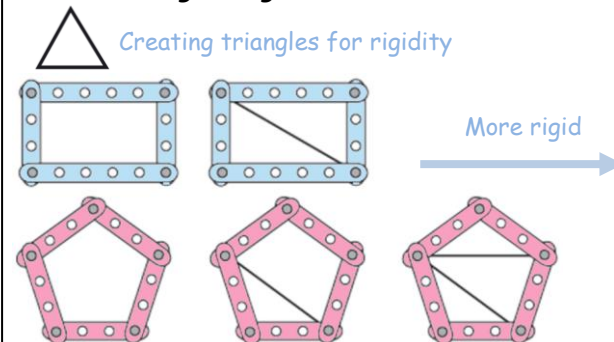
Joining straws



Joining thin sectioned pieces of wood

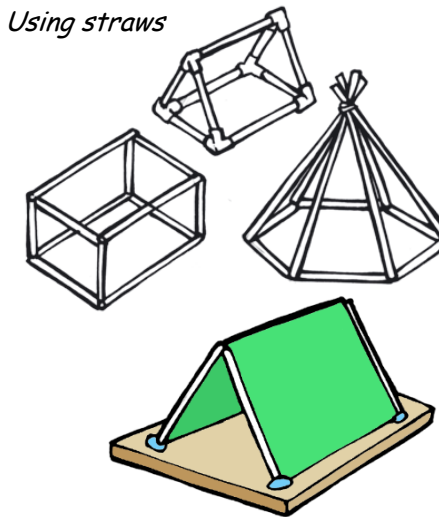


Understanding triangulation

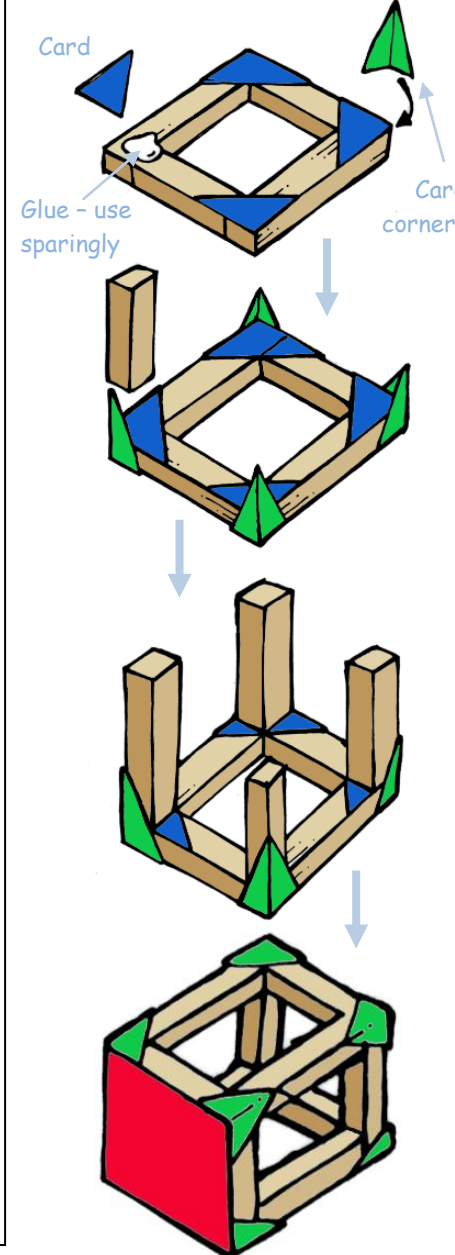


Making small-scale frame structures

Using straws



Using square section wood



Designing and making a small-scale bird hide for children to use in the school wildlife area

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

THOUGHT	ACTION
What type of structure shall I make? What will be its purpose? Who will use it?	Discussing ideas, drawing annotated sketches Generating a simple design specification
Which will be the best shape for my bird hide? What features will it have?	Discussing, modelling and evaluating different options
Which materials will I use to make it? How will I make it strong and waterproof?	Investigating and testing possible materials Discussing, exploring and evaluating prototypes
What will I use to cover the structure of my shelter? What tools and materials will I need?	Discussing, exploring and evaluating different fabric and rigid covering options
What order will I work in? Will I work with someone? What constraints I am working to?	Negotiating, developing and agreeing a step-by-step-plan
Do I need to change anything?	Discussing, testing and modifying the design
Will my product meet the needs of the user?	Evaluating the product with the intended user and against the original design specification

Glossary

- **Modelling** - the process of making a 3-D representation of a structure or product.
- **Compression** - the application of pressure to squeeze an object.
- **Strut** - a part of a structure under compression.
- **Tension** - a force pulling on a material or structure.
- **Tie** - a part of a structure under tension.
- **Diagonal** - a straight line that goes from one corner to another inside a shape.
- **Horizontal** - a line that is parallel to the ground.
- **Vertical** - a line that is at right angles to the ground.
- **Triangulation** - the use of triangular shapes to strengthen a structure.
- **Frame structure** - a structure made from thin components e.g. tent frame.