

**Year 5 Planning**  
**DESIGN AND TECHNOLOGY**  
**Structures – Frame Structures**  
 Strengthen, stiffen and reinforce complex structures

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.

**Lesson 1 - TECHNICAL KNOWLEDGE/MAKE SKILL KNOWLEDGE RECORDED IN KEY SKILLS BOOKS**

**WALT: Understand how to strengthen, stiffen and reinforce 3-D frameworks**

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

**TYPES OF FRAME STRUCTURE**

Collect a range of photographs of different frame structures, both portable and permanent e.g. tents, bus shelters, bird hides. Discuss with children the types of structures they can see. *How are they made? What forms can you see?*

**FOCUSED TASKS (FTs)**

Provide children with a range of photographs of frame structures that use triangles for rigidity. Model using a construction kit consisting of plastic strips and paper fasteners to build 2-D frameworks. Ask children to compare the strength of square frameworks with triangular frameworks.

**Lesson 2 – EVALUATING COMPLETE PAGES 2-3 FROM ACCOMPANYING BOOKLET**

**WALT: Investigate and analyse a range of products**

**INVESTIGATIVE AND EVALUATIVE ACTIVITIES (IEAS)**

Investigate and evaluate a range of existing frame structures. Take children on a local 'frame structures' trail to help them get ideas for their own products and understand construction techniques.

**LINKS TO OUTDOOR LEARNING – MAKE LARGE FRAME STRUCTURES USING STICKS AND NATURAL MATERIALS**

**EVALUATING FRAME STRUCTURES**

Ask children to collect examples of a range of portable and permanent frame structures. Get children to make an annotated drawing of a frame structure and comment on its use of triangulation to improve its strength and reinforcement. Alternatively, children could take photographs of the product and annotate (see page 2).

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*

**Lesson 3 - DESIGNING COMPLETE PAGE 4 FROM ACCOMPANYING BOOKLET**

**WALT: Develop a simple design specification to inform product development.**

**CARRY OUT RESEARCH**

Get children to carry out research into user needs by completing a survey, interview or questionnaire in order to develop a design specification for their product.

- Purpose of the product
- Intended Users
- Popular themes
- Context of product

Children must carefully consider the purpose and intended user for their product.

**LINKED TO 3<sup>RD</sup> HOUR ACTIVITY**

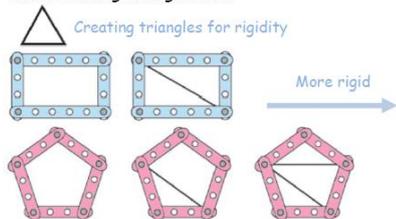
**CREATING A DESIGN BRIEF**

Discuss with the children what they could design, make and evaluate? What type of structure should they make?

In groups, children need to discuss the brief of designing and making a small-scale frame structure e.g.

*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?*

**Understanding triangulation**

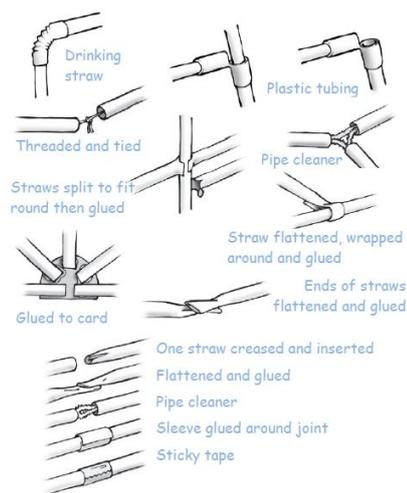


Ask children to record a diagram of their framework with an explanation of how structures can be reinforced using triangulation.

**TECHNIQUES FOR BUILDING FRAME STRUCTURES**

Model how to join straws using the different techniques outlined below:

**Joining straws**



Ask children to record the process of investigating these techniques for joining using annotated drawings in their keys skills book.

Ask children to mount their joints onto card for future reference and **ATTACH JOINING TECHNIQUES TO PAGE 1** of the booklet.

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?



**EDWARD DE BONO THINKING HATS**

Next, ask children to record answers to these questions against **Edward De Bono Thinking Hats**. Explain what each hat represents.

- **WHITE: Facts**
- **RED: Feelings**
- **BLACK: Problems**
- **GREEN: Creativity**
- **YELLOW: Benefits**
- **BLUE: Process**

Encourage children to look for different types of frame structures in the home and in school. Children could print images from the internet to add to their 'mood' board and annotate.

How will it be reinforced? How will it be finished?

Get children to mind map a list of ideas on what they could design, make and evaluate? e.g playground shelter, market stall, tent, playhouse, bird hide, park furniture. (see page 4 of booklet for a detailed list).

**THE DESIGN BRIEF**

Now model how to develop an authentic and meaningful design brief with the children based on their research - this should consist of no more than seven criteria their product must meet e.g. the product was be weather proof. Show children examples of design briefs for products and explain that the design brief must concentrate on design outcomes (like size, function) not specific product details (like colour). The design brief will allow children to focus on the problem they are solving and what they are trying to achieve from the product.

Develop a project title from the results:

**Design, make and evaluate a**  
 \_\_\_\_\_ (product) for  
 \_\_\_\_\_ (user) for  
 \_\_\_\_\_ (purpose).

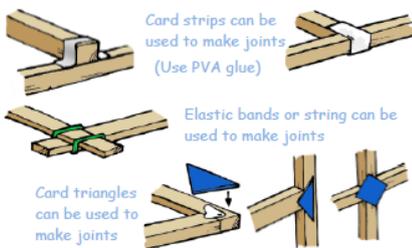
**Lesson 4 - TECHNICAL KNOWLEDGE/MAKE KNOWLEDGE TO BE RECORDED IN KEY SKILLS BOOKS**

**WALT: Demonstrate techniques for accurately joining framework materials**

**FOCUSED TASKS (FTs)**

Model how to join thin sectioned pieces of wood using the different techniques outlined below:

*Joining thin sectioned pieces of wood*

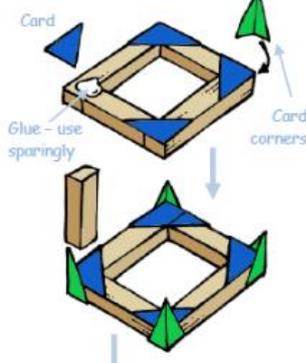


Get children to practise these techniques ensuring children are familiar with all the materials they are likely to use and that these are made easily available and accessible.

**USING SQUARE SECTIONS OF WOOD**

Show the children how to make a small-scale frame structure using pieces of thin-sectioned wood and card triangles by following the diagram below.

*Using square section wood*



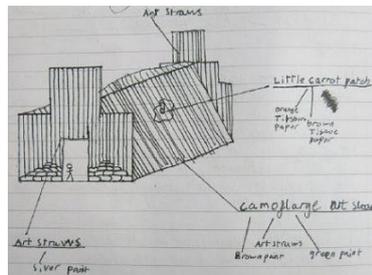
**Lesson 5 - DESIGNING COMPLETE PAGES 5-6 FROM ACCOMPANYING BOOKLET**

**WALT: Generate innovative ideas through annotated sketches**

In this lesson, model how to communicate ideas through detailed, annotated sketches.

**WORKING DRAWINGS**

Ask children to create initial design sketches of their frame structure design. Children annotate their working drawing explaining their thought process and techniques.



The drawings should indicate the design decisions made, including the location of the **components**, **how they work as a system**, **materials**, **dimensions**, and the **appearance and finishing techniques** for the product.

Children to consider the following questions:

- Which materials will I use to make it?*
- How will I make it fit for purpose?*

**USING COMPUTER-AIDED DESIGN**

Extend children to develop their computer-aided design (CAD) skills by using such as Techsoft 2D Primary or Microsoft Word to generate and modify appearance and finishing techniques for the product. Children should recognise that designs can be

**Lesson 6 – MAKING COMPLETE PAGES 7-9 FROM ACCOMPANYING BOOKLET**

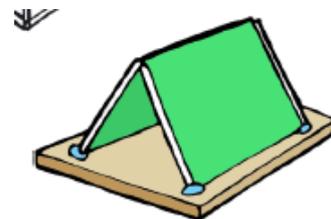
**WALT: Produce a step-by-step plan and lists of tools, equipment and materials**

**MAKING A PROTOTYPE**

Ask children to consider the following questions when making their prototype:

- *What tools and materials will I need?*
- *What order will I work in?*
- *What constraints am I working to?*
- *Do I need to change anything?*
- *Will my product meet the needs, wants and interests of the user group?*

Applying their knowledge, understanding and skills from **Focused Tasks (FTs)**, children should make a high quality prototype using paper straws, paper and inexpensive material. *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?*

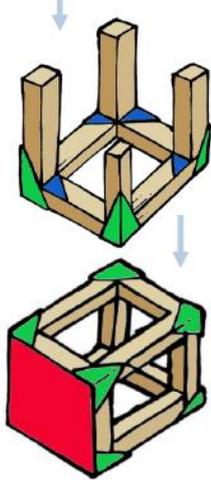


*Example prototype for a tent*

**RECORD THE MAKE**

Get children to produce a detailed, step-by-step plan, listing tools and materials. Children can take photographs at each stage of the make [see page 7 of booklet].

Provide each children with long piece of baton to saw into 2 x 20cm length and 2 x 10cm length pieces. Model how to use the card triangles to join the edges of the wood together.



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 wood frames, as appropriate.

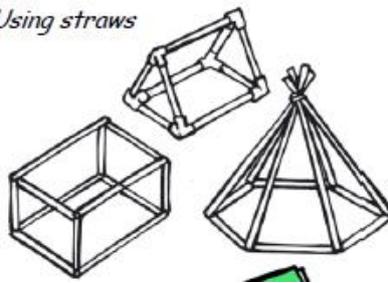
easily modified and repeated on the computer without the need for a physical product.

### USING STRAWS TO AID DRAWING

#### LINK TO 3<sup>RD</sup> HOUR AND MATHS

Get children to make an easy teaching aids by demonstrating 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.

*Using straws*



*How could each of the frameworks be reinforced and strengthened?*

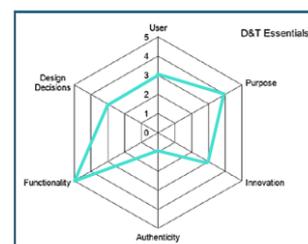
Ask children to explore a range of textiles to compare their properties in terms of water resistance and strength. They could test how the use of a textiles cover can strengthen a structure. Discuss the impact of the technique on water resistance, strength and appearance.

#### LINKS TO SCIENCE

### CRITICALLY EVALUATE THE DESIGN

Encourage children not to be afraid to include any failed designs into displays of final products. Include evaluations of why the designs didn't work and how children would make them work. This links to design in the real world and the concept that designs don't always work first time around.

Discuss the model below and key terminology [REFER TO PAGE 14 in booklet]. Show children how to evaluate against the six essential characteristics by giving it a score from 0-5, with 0 being the lowest score.



Note:

One Project booklet is required per child for the entire 6-week unit. Preferably A3 size.

During the first 3 weeks of the modelling teaching sequence, children will complete the first half of their booklet outlined in the plans above. When creating the design brief and communication of ideas, children must decide in their groups on a product they would like to manufacture.

Lesson 6 requires children to make a prototype of their chosen design using materials and skills obtained through focused tasks (FTs).

Throughout the application weeks, children will work in their groups and complete the second half of their project booklet [pages 10-15]. Outlined below are the tasks children are required to complete.

**Application of Skill**

**TASK SHEET**

**Structures – Frame Structures**

Strengthen, stiffen and reinforce complex structures

1. Make a high quality product, applying knowledge, understanding and skills from IEAs and FTs. Include a photograph and drawing of the finished product. [page 11-12]
2. Compare the final product to the original design specification. [page 12]
3. Test products with the intended user, where safe and practical [page 13]
4. Critically evaluate the quality of the design, manufacture, functionality and fitness for purpose. [page 14]
5. Consider the views of others to improve your work using Thinking Hats [page 15]
6. **ENGLISH TASK - Research a key event or individual related to frame structures e.g. Stephen Sauvestre – a designer of the Eiffel Tower; Thomas Franolls Pritchard- designer of the Iron Bridge. You could also learn about locally important design and technology.**