

ACET Junior Academies

Scheme of Work for Design Technology
Y6 Structures - Frame Structures



About this unit: In this unit pupils will learn about frame structure products and how structures have developed over time. They will link to learning in Science to look at how structures have been adapted to make them taller, longer, stronger, more innovative. They will explore and evaluate a range of frame structures including towers, bridges, buildings and visitor centres, identifying how the structures have been made and how materials have been stiffened and strengthened. Children will practise making frame structures using construction kits and other materials, reinforcing square structures with diagonals to develop an understanding of triangulation. Pupils will design a frame structure product for an intended user and purpose. They will apply their learning from the unit to make their product and will evaluate their completed products, judging the extent to which they have met the original design criteria.

Final piece ideas:- bridge, towers, building, visitor centre, observation wheels - pupils will focus on innovative designs (link Science - Evolution/Classification)

Unit structure

1. Investigate and Evaluate - What are frame structures?
2. Focused Tasks - How are frame structures made?
3. Designing - What could I make and how could I make it?

Links to previous and future National Curriculum units

- KS1 - Freestanding structures

4. Making - Planning and making - Can I make the product I designed?
5. Making - Finishing - Is my product finished?
6. Evaluating - What worked well? What improvements could I make?

- LKS2 - Shell structures

1: Investigate and Evaluate - What are frame structures?

Links to previous learning	Knowledge and second order concepts	Skills, Concepts and Vocabulary:	Assessment criteria:	Curricular links:
<p>Pupils will have experience of measuring, marking out, cutting, joining, shaping and finishing techniques with construction materials. Pupils will have a basic understanding of what structures are and how they can be made stronger, stiffer and more stable.</p>	<p>Substantive knowledge: (<i>What students should know.</i>) That there are a range of frame structures. That products should be evaluated on design, manufacture, appearance and use. Research key events and individuals relevant to frame structures.</p> <p>Second order concepts: (<i>What students should understand</i>) Evaluation Functionality Innovation</p>	<p>Skills - Evaluating existing products:</p> <ul style="list-style-type: none"> • Carry out thorough evaluations of existing products, considering how well they have been made, the materials chosen, whether they work, how they have been made and if they are fit for purpose. • Identify what the product has been made from and research and discuss how sustainable the materials are. • Evaluate how much products cost to make and how innovative they are. • Consider the impact of products beyond their intended purpose. 	<p>Can your children: Explore a range of portable and permanent frame structure products. Understand what products are and what their purpose is. Evaluate products on design, manufacture, appearance and use.</p>	<p>Horizontal: Science - materials and properties History - Key events/individuals. Maths - 2D/3D shapes and properties Spoken language - ask questions, formulate, articulate and justify answers, arguments and opinions; consider and evaluate different viewpoints.</p> <p>Vertical:</p>

		<p>Key vocabulary/concepts: https://20353.stem.org.uk/Nuffield%20Glossary2/index.html</p> <p>Evaluate, user, purpose, product, function, functionality, design decisions, innovation, research, frame structure, stability, strengthen, reinforce, stiffen, portable, permanent</p>		
Suggested activities:		Resources:	Useful links:	
<p>Use videos/images of frame structures e.g. bridges, towers, visitor centres etc. Use questions to develop understanding e.g. <i>How well does the frame structure meet the 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 well 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?</i></p> <p>Encourage pupils to look closely at the products and create observational drawings.</p> <p>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 - the designer of the Iron Bridge, Nicholas Grimshaw - Eden Project/waterloo stations</p> <p>Pupils apply their learning by completing an evaluation of a chosen product.</p>		<p>Range of existing frame structure products</p> <p>Images and film clips of existing frame structures that cannot be explored physically.</p>	<p>https://www.tes.com/teaching-resource/year-6-structures-work-booklet-6011843</p> <p>https://www.stem.org.uk/resources/elibrary/resource/25329/bridges-and-structures</p> <p>https://www.britannica.com/topic/architecture/Framed-structures</p>	
2: Focused Tasks - How do you make frame structures?				
Links to previous learning	Knowledge and second order concepts	Skills, Concepts and Vocabulary:	Assessment criteria:	Curricular links:

<p>Pupils will have explored and analysed a range of frame structure products, identifying what they are and what their purpose is. They will have evaluated products on design, manufacture, appearance and use.</p>	<p>Substantive knowledge: (<i>What students should know.</i>) Understand how to strengthen, stiffen and reinforce 3D frameworks. Know and use technical vocabulary relevant to the project.</p> <p>Second order concepts: (<i>What students should understand</i>) Triangulation Tessellation Reinforce</p>	<p>Skills</p> <ul style="list-style-type: none"> • Know how to use learning from Science and maths to help design and make a wide range of products that work • Accurately measure, mark out, cut and shape materials and components demonstrating skills in using tools and equipment safely and accurately. • Accurately assemble, join and combine materials and components • Know how to reinforce and strengthen a 3D framework • Know the correct technical vocabulary for the projects they are undertaking <p>Key vocabulary/concepts: Frame structure, stiffen, strengthen, reinforce, triangulation, stability, shape, join,</p>	<p>Can your children: Understand and explain how to strengthen 2D and 3D frames? Use construction kits to create and strengthen frameworks. Use tools and equipment to measure, mark out cut and join materials to make frameworks?.</p>	<p>Horizontal: Maths - shapes; tessellation; carry out accurate measuring (cm/mm) Spoken language - ask questions, formulate, articulate and justify answers</p> <p>Vertical:</p>
<p>Suggested activities:</p>		<p>Resources:</p>	<p>Useful links:</p>	
<p>Pupils use construction kits and other materials to build 2D frameworks. Pupils create square and triangular frameworks and compare the strength of both. Pupils investigate strengthening square frameworks using diagonals to help develop an understanding of using triangulation to add strength to a structure. Pupils explore tessellation with different 2D shapes to see how they fit together and strengthen structures. Pupils investigate using paper straws, pipe cleaners, spaghetti, cocktail sticks etc to build 3D frameworks such as cubes, cuboids and pyramids. Encourage children to consider how each of the frameworks could be reinforced and strengthened. Demonstrate the accurate use of tools and equipment e.g. junior hacksaws, G-clamps, bench hooks, square section wood, card triangles and hand drills to</p>		<p>Card, paper straws, spaghetti, cocktail sticks, gum drop sweets, marshmallows, square sectioned wood, masking tape, PVA glue, pipe cleaners, pencils, rulers, scissors, bench hooks, G-clamp, junior hacksaws, glass paper</p>	<p>https://www.wonkeedonkeetools.co.uk/handsaws/how-to-use-a-junior-hacksaw</p>	

construct wooden frames. Children practise these skills in constructing their own wooden frames.		
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3: Designing - What could I make and how could I make it?

Links to previous learning	Knowledge and second order concepts	Skills, Concepts and Vocabulary:	Assessment criteria:	Curricular links:
<p>Children will have an understanding of frame structures. They will know how materials are joined and how structures can be strengthened and reinforced. Pupils will know how to use tools and equipment to mark, cut, join and shape materials safely.</p>	<p>Substantive knowledge: <i>(What students should know.)</i> That a design brief outlines what a user wants a product to be like. That research should be carried out to inform design ideas. That responses from research should be used to inform the design specification. Take account of the constraints of time, resources and cost.</p> <p>Second order concepts: <i>(What students should understand)</i> Triangulation Reinforce Tessellation</p>	<p>Skills</p> <ul style="list-style-type: none"> • Describe the purpose of their product and the features that will appeal to the user • Explain how particular parts of their product work • Gather information about the needs, wants, preferences and values of particular individuals and groups, carrying out surveys, questionnaires etc. • Develop a design specification for their design. • Draw on research, including surveys, research to generate innovative ideas • Model ideas through the use of prototypes and pattern pieces. • Communicate and represent ideas through exploded diagrams, annotated sketches, cross sectional drawing and computer based programmes (where appropriate) 	<p>Can your children: Develop ideas about the product they are going to make based on the needs, wants, preference and values of the user. Communicate ideas through annotated sketches and prototypes. Produce detailed step-by-step plans of how the product will be made including lists of tools, equipment and materials needed.</p>	<p>Horizontal: Spoken language - participate in discussion with adults and peers to generate, develop and communicate ideas. Ask relevant questions and give well-structured responses. Art and design - use drawings and sketches to generate and communicate ideas. Science - properties of materials</p> <p>Vertical:</p>

		<ul style="list-style-type: none"> • Make design decisions taking into account constraints such as time, resources and cost <p>Key vocabulary/concepts: Design decisions, functionality, innovation, authentic, user, purpose, design specification, design brief, annotated drawings, mock-up, prototype</p>		
Suggested activities:		Resources:	Useful links:	
<p>Develop a design brief with pupils within a context which is authentic and meaningful, e.g. a new innovative visitor centre, viewing tower, observation wheel bridge etc. Children carry out research including surveys, interviews and questionnaires to help generate innovative ideas. They develop a design specification for their product, carefully considering the purpose and intended user for their product.</p> <p>Encourage children to develop ideas by asking questions e.g. <i>Who is the intended user? What is the purpose of the frame structure? What materials will you use? How will it be joined? How will it be reinforced? How will it be finished?</i> Children develop a design specification to guide their thinking. And make annotated sketches of their ideas from different viewpoints.</p> <p>Provide materials such as paper, cards, paper straws etc, for children to model their ideas. Encourage children to develop their ideas through questions e.g. <i>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?</i></p> <p>Children produce a step-by-step plan listing tools and materials.</p>				
4: Making - Can I make the product I designed?				
Links to previous learning	Knowledge and second order concepts	Skills, Concepts and Vocabulary:	Assessment criteria:	Curricular links:

<p>Pupils will have carried out research and developed ideas based on the needs, wants, preferences and values of an intended user. They will have communicated ideas through drawings and diagrams. Pupils will have considered the stages of making and will have produced a step-by-step plan.</p>	<p>(To be completed over two lessons)</p> <p>Substantive knowledge: (<i>What students should know.</i>) How to select and accurately assemble materials. How shapes can be reinforced. Continually evaluate and modify the working features of the product to match the design specification.</p> <p>Second order concepts: (<i>What students should understand</i>) Triangulation Reinforce Tessellation</p>	<p>Skills</p> <ul style="list-style-type: none"> • how to reinforce and strengthen a 3D framework • Use a wide range of materials and components • Work safely, hygienically and accurately with a wide range of tools. • Accurately measure, mark out, cut and shape materials and components demonstrating skills in using tools and equipment safely and accurately. • Accurately assemble, join and combine materials and components • Accurately apply a range of finishing techniques that involve a number of steps, including those learnt in Art • Demonstrate resourcefulness when tackling practical problems. <p>Key vocabulary/concepts: Intended user, purpose, design criteria, design specification, design brief, frame structure, stiffen, strengthen, reinforce, triangulation, stability, shape, join,</p>	<p>Can your children: Accurately measure, mark out and cut out materials? Accurately assemble, join and combine materials to create products? Consider the purpose and the needs of the intended user? Accurately apply a range of finishing techniques suitable for the product they are making, including those learned in Art? Evaluate evolving work and use problem solving skills when encountering mistakes or problems?</p>	<p>Horizontal: Science - properties of materials Maths - carry out accurate measurements (cm/mm)</p> <p>Vertical:</p>
<p>Suggested activities:</p>		<p>Resources:</p>	<p>Useful links:</p>	
<p>Give pupils the opportunity to revisit their design specifications and step-by-step plans. Pupils collect the materials and tools required for their product and apply the knowledge, skills and techniques learned from previous lessons when making their products. Encourage the children to critically evaluate their developing</p>		<p>Card, paper straws, square sectioned wood, masking tape, PVA glue, pipe cleaners, pencils, rulers, scissors, bench hooks, G-</p>		

<p>products against the original design specification. Pupils make changes to their products as they work to overcome any problems that arise or to make improvements. Pupils record and changes made on their plans.</p> <p>Pupils select appropriate materials and decorating finishing techniques to produce a well finished final product that matches the intended user and purpose. Pupils evaluate their ongoing work, drawing on their design specification and thinking about the intended purpose and user. Encourage pupils to use problem solving skills when they encounter mistakes or problems.</p>	<p>clamp, junior hacksaws, glass paper</p> <p>Finishing resources, e.g. pens, pencils, paint, glue,</p>	
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5: Evaluating - What worked well? What improvements could I make?

Links to previous learning	Knowledge and second order concepts	Skills, Concepts and Vocabulary:	Assessment criteria:	Curricular links:
<p>Children will have generated and developed ideas for their product. They will have explored different frame structures and designed a product with an intended purpose for an intended user. They will have chosen techniques to make and finish their product. They will have evaluated their evolving work and overcome problems using problems solving skills.</p>	<p>Substantive knowledge: (What students should know.) That evaluations identify the strengths and areas for development in terms of quality of design, manufacture and whether it is fit for purpose. That products should be tested by the intended user. That products are continually developing through evaluating and identifying improvements. That views from the user should be considered when identifying areas for improvement</p> <p>Second order concepts: (What students should understand) Evaluate Develop Evolve Innovative</p>	<p>Skills</p> <ul style="list-style-type: none"> Use their design criteria to critically evaluate their product in terms of quality of design, manufacture and whether is it fit for its intended purpose. Consider the views of others, including intended users, to improve their work. <p>Key vocabulary/concepts: Evaluate, design criteria, design brief, innovative, user, purpose, authentic, innovative, function, product, ideas, appeal, finish, improve</p>	<p>Can your children: Use their design criteria to critically evaluate their product in terms of quality of design, manufacture and whether it is fit for the intended purpose? Consider the views of others when evaluating their work and identifying improvements that could be made.</p>	<p>Horizontal: Spoken language - as questions, formulate, articulate and justify answers, arguments and opinions; consider and evaluate different viewpoints</p> <p>Vertical:</p>
Suggested activities:		Resources:	Useful links:	
<p>Pupils evaluate their final products, comparing it to the original design specification. They should critically evaluate the quality of design, the</p>		<p>Final products Evaluation resources</p>		

manufacture, functionality, innovation and fitness for the intended user and for purpose. against the design criteria. They consider the extent to which the product meets the needs of the intended user and suits the intended purpose.

Does the product suit the purpose? Does it suit the intended user? Is the structure stable? Have materials been accurately and securely joined? Has the structure been made strong enough? Is the enough reinforcement? Are the materials suitable for the product? How well has the product been made? How well has it been finished? Could the product have been made more appealing?

Where possible allow feedback from the intended user.

Pupils complete an evaluation for their own product.