



**SUNDERLAND
CULTURE**



**Lesson plan created by Tina Corri
on behalf of Sunderland Culture**

STEAM

Teachers Notes and Lesson Plans
for KS2/KS3 Teachers



Northern Gallery for
Contemporary Art



SUNDERLAND
MUSEUM & WINTER GARDENS



Welcome to Sunderland Culture's Cultural Toolkit for STEAM activities!

This resource contains notes and lesson plans linking to STEAM education. They are created for KS2 and KS3 teachers, and are editable.

They are designed to be easy to use, adaptable and creative - ready to plug in and play. The activities have been developed in partnership with teachers, and take Sunderland's people and places as their inspiration.

Teacher Notes - Introduction to STEAM

What is STEAM?

STEAM stands for Science, Technology, Engineering, Art and Maths. By placing art at the heart of STEM education, it recognises the vital role of the arts and creativity in scientific discoveries, innovative design, and ground-breaking engineering.

STEAM education explores what happens when you combine these different subjects together as a way to explore real-world situations and challenges. It is an approach which encourages invention and curiosity through creative, hands-on and experimental learning. At the core of STEAM education are two key concepts:

1. **Integration** - teaching subjects in an integrated way rather than separately, with project-based and inquiry-based lessons, where subjects support and complement each other.
2. **Linking with real-life situations** - using knowledge and approaches from the different STEAM subjects and applying them to everyday scenarios or future problems.

Why is STEAM important?

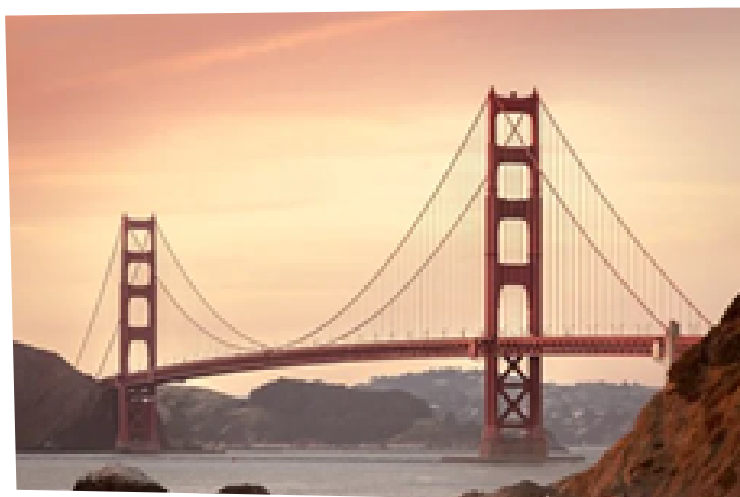
STEAM education helps children to develop skills that are important in their daily lives now, but also equips them for the future - for how we will live, learn, work and help each other in the 21st century. In particular, STEAM activities can support children's skills in: -

- critical thinking
- creative thinking
- teamwork and communication
- problem solving
- risk taking and experimentation

Most situations and jobs don't tend to rely on just one subject or skill, but require various areas of knowledge and perspectives. STEAM celebrates the coming together of these different disciplines to find new ways of doing things.

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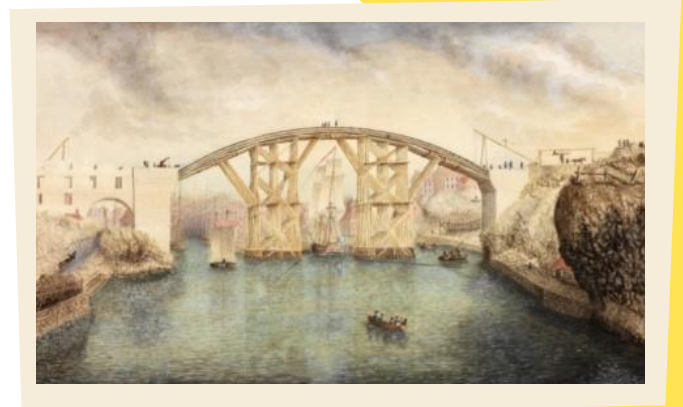
Solving problems

For example, architects use their imagination and visual skills as well as their understanding of maths, science and engineering to create new structures and buildings.

STEAM education can help to inspire the designers and inventors of the future!

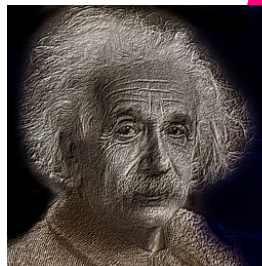
Inspiring People

Our interests, like subjects, don't always fit into neat boxes - we aren't necessarily scientists or artists, writers or mathematicians, engineers or musicians.



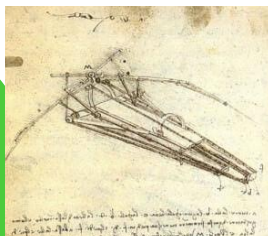
Sunderland Bridge under Construction, 1795, unknown artist

Albert Einstein, for example, was a violinist as well as a scientist. He often used patterns he saw in music to help his scientific ideas.



"The greatest scientists are artists as well. Logic will get you from A to B. Imagination will take you everywhere"

"Study the science of art. Study the art of science. Realize that everything connects to everything else."



Drawing of a Flying Machine, 1485

Leonardo da Vinci, famously, wasn't just a painter. Amongst other things, he was a writer, engineer, sculptor, inventor, botanist, mathematician and vegetarian. His sketchbooks show his designs for inventions that could only be realised hundreds of years later, such as the first parachute, helicopter and hang glider.

Sir Joseph Swan, the Sunderland-born inventor and creator of the first incandescent lightbulb, was also a photography pioneer, as well as a chemist and a businessman. Thanks to him we can – literally - see our world in a new way.



"An inventor is an opportunist. In every case the inventor uses the work of others"

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**“There are
360°, so why
stick to one?”**



Dame Zaha Hadid made buildings known for their futuristic designs, with dramatic curves and shapes.

For years, people thought her ideas were impossible, until technology caught up, such as CAD (Computer Aided Design) and CAM (Computer Aided Manufacturing).

Nordpark Cable Railway,
Austria, 2005

Teacher Notes – Introduction to Building Bridges

Building Bridges

These teachers notes and related lesson plans explore the theme of bridges - their different designs, functions and technologies. They celebrate some of the engineering miracles that are part of Sunderland's cityscape and identity, from Wearmouth Bridge to the Northern Spire.

Pupils are also asked to explore what bridges might look like and be made from in the future, by taking part in a bridge building challenge!

The Teachers' Notes provide contextual information, guidance on the lesson plans, and links to other sources.

The Lesson Plans take the form of editable PowerPoints with slide notes and embedded links, (such as film clips), ready to download, adapt if needed and use.

They can be used to support:

- individual lesson plans to dip in and out of as needed.
- whole day activities as part of a Design Week, Arts Week, STEAM or STEM event.
- a scheme of work, introducing pupils to the story of this life-changing invention.
- assemblies on themes such as STEAM careers, local landmarks or local connections.

Learning Objectives:

- To understand the importance of bridge building in connecting people and places, and how it has changed how people live, work and travel.
- To understand the key principles of bridge design – function, forces and strength.
- To explore what kind of bridges and bridge designs we will need in the future, through hands-on, experimental activities.

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Curriculum Links:

- **Science:** weight, forces, gravity, materials, connecting scientific ideas with practical activities
- **Art & Design:** visualising and developing ideas, drawing, exploring work of other designers
- **D & T:** materials, design process, new technologies, engineering, responding to a brief
- **Geography:** trade, transport and communications
- **Maths:** Problem solving, shapes, geometry.
- **History:** local and social history, Industrial Revolution.
- **Literacy:** expressing ideas, speaking and listening.

Skills:

- Teamwork, communication
- Problem solving, creative thinking, adapting ideas.
- Visualisation, experimentation.

Teachers Notes – Building Bridges – Contextual Information

An introduction to the Lesson Plans

Bridges are a major part of Sunderland's identity and culture, many of which are famous landmarks - both old and new. This is hardly surprising as the City of Sunderland is positioned on the mouth of the River Wear, and has a remarkable history of construction, ship building and engineering - not to mention coalmining and glass making. The bridges are both a reflection and a reminder of this.

These notes give some context and background information about bridge building in Sunderland to support the following lesson plans:

- **An Introduction to Building Bridges.** This lesson plan focuses on why we need bridges, who uses them, what materials they are made from, the main types of bridges, and how they work (forces). It also gives pupils some quick bridge building challenges using just paper, teamwork and their imagination. It introduces the general theme of bridges, with local and international examples.
- **Design a Bridge for the Future!** This lesson plan is much more practical and hands-on, inviting pupils to work in groups to create a future bridge for Sunderland. They have to consider materials (including how sustainable it will be), its aesthetics (how it looks), its function (who is it for, where will it be, what does it need to do) and its strength. Pupils are invited to work in small teams and go through the kind of design process designers and architects would use in real life when working on a civil engineering project, such as designing a new bridge.

Whilst the inspiration comes from Sunderland's bridges, the same approaches could be used for other towns, cities and countries.

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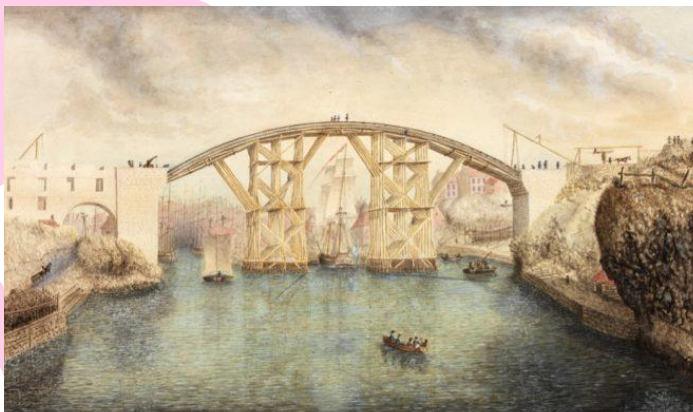
Sunderland Harbour 1899,
by Louis Hubbard Grimshaw (1870-1944)
Sunderland Museum & Winter Gardens

Sunderland's Bridges

Sunderland Bridge, 1795

This painting, which is in Sunderland Museum & Winter Gardens, shows Sunderland's earliest major bridge. It is in fact the first version of what we now know as Wearmouth Bridge.

The image shows the bridge being built in 1795, with enormous wooden scaffolding rising up out of the river, in order to help workers build the arch. We can see materials being winched upwards from each side, and gaps left for ships to be able to continue travelling and trading.



Sunderland Bridge under Construction, 1795,
unknown artist.
Photo: Sunderland Museum & Winter Gardens

When completed, Sunderland Bridge was extremely famous. This is because it was the second cast iron bridge to be built in all of England, after the Ironbridge in Staffordshire, when iron was still new, modern and surprising. It was built by Rowland Burdon who was a local industrialist, who bought and adapted sections of a bridge from an iron company in Rotherham, which were originally meant to go to America. It was designed by engineer Thomas Paine.

Sunderland Bridge was also twice as wide. In fact, at the time, it was the biggest single-span bridge in the whole world! Sunderland Bridge was 250 feet wide – wider than the Angel of the North!



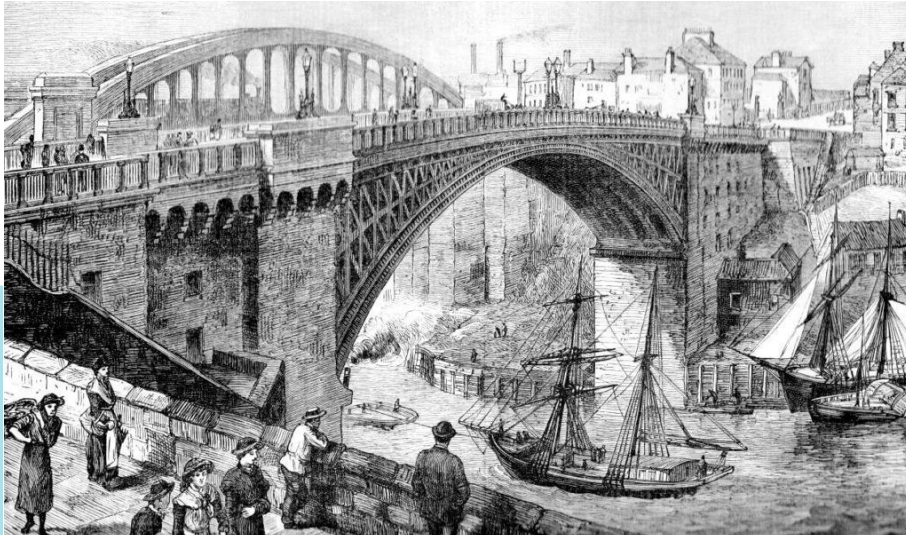
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Connecting Communities

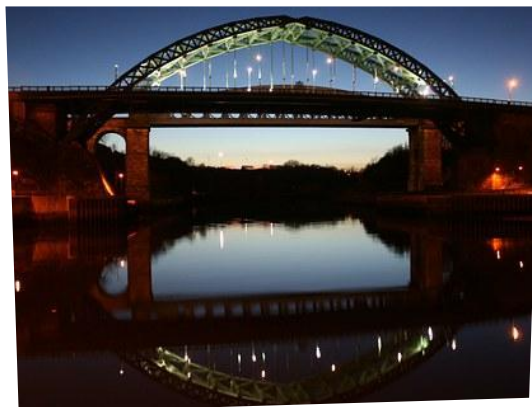
Sunderland Bridge was built to link Monkwearmouth on the north of the River Wear, with Bishopwearmouth and the port of Sunderland on the south. When the bridge opened it was a huge occasion because it linked communities on both sides of the River Wear together. Before the bridge, people had to take a ferry.

Sunderland Bridge / Old Wearmouth Bridge, 19th century



The image above shows the bridge as it was in the 19th century. The original structure had undergone some changes, by railway engineer Robert Stephenson, son of George Stephenson, who was from Tyneside. The abutments have been made higher, so the arch looks lower and flatter. The bridge still looks like an engineering miracle, and also a true connector of people and industry - it is bustling with pedestrians, the river is full of ships, with the railway bridge behind.

Wearmouth Bridge, opened 1929



This is the version that still stands today. Like the original bridge, it has a through arch design and is made of iron. It was built in 1928-9 by Sir William Arrol and Company Ltd, and designed by Mott, Hay and Anderson. Until 1954 it still carried trams.

Wearmouth Bridge links Monkwearmouth with the main shopping centre, and carries four lanes of traffic. It still has the railway bridge – Monkwearmouth Railway Bridge, built in 1879, behind.

It is the final bridge before the River Wear meets the North Sea.

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Victoria Viaduct, 1838



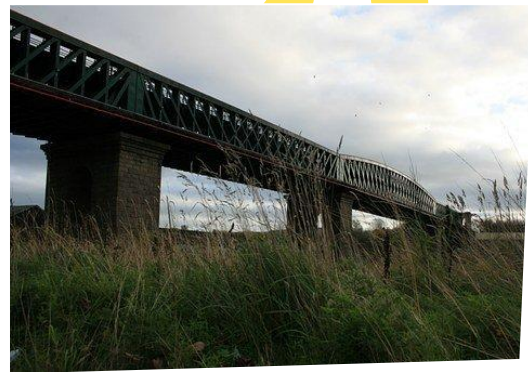
Known originally as Victoria bridge, it was named after Queen Victoria's coronation because it was completed on the same day. It was built for trains and pedestrians as part of the Durham Junction Railway. It is built from local sandstone, based on a Roman arch design. When first erected, it was one of the largest stone arch bridges in Europe.

It stopped taking passengers in the 1960s and stopped taking freight trains in 1991 when it closed.

Queen Alexandra Bridge, 1909

This is a huge bridge made of steel with three tiers and a truss design, built for the Northern Eastern Railway Company to transport coal to Sunderland from the pits in Durham.

It was also built to make road links better on either side of the Wear. In other words - it was a double decker bridge. It is now only used as a road, with the rail track removed.



Northern Spire, 2018

The Northern Spire is the most recent of Sunderland's bridges and has become a huge landmark. It is the first bridge to be built for 40 years. The bridge is found in the West of the City of Sunderland, connecting Castletown to the north and Pallion in the south. It was built to relieve congestion and connect both parts of the city. The name was decided by an online and postal poll.

It is a cable-stayed bridge, with a pylon over 100 meters high! This is taller than Big Ben and twice as high as the Millennium Bridge, Gateshead.



Northern Spire
105m



Big Ben clock tower
96m



Millennium Bridge
50m

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What next?

There are plans for a new £31m footbridge connecting the north and south of the city, between the Stadium of Light, Sunderland's football stadium, and the new Riverside Development, as part of a regeneration scheme. It is hoped that it will be completed by 2023 if all goes to plan. As with the Northern Spire design, the design will be decided by a competition.



Artist's impression,
Sunderland City Council

It would be wonderful to see what kind of designs your pupils come up with for a future bridge design for Sunderland. Please do feel free to share them with us on X?

Useful links

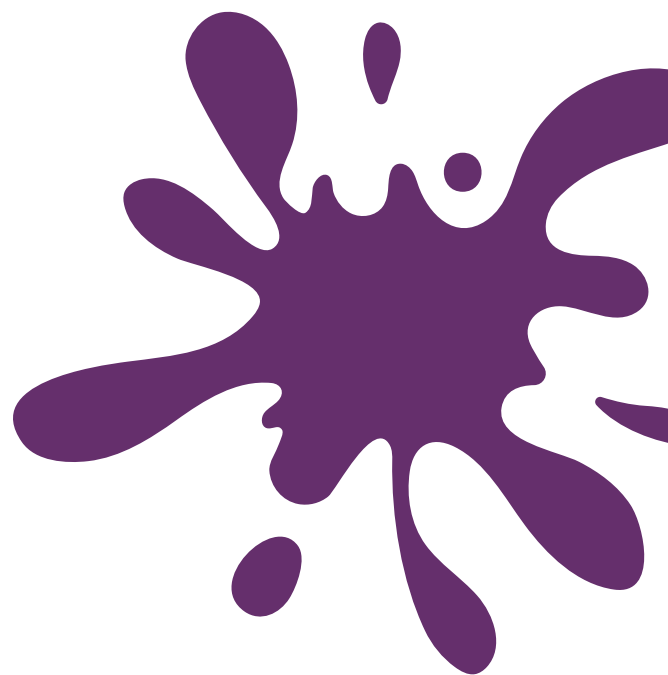
www.littleinventors.org

www.jamesdysonfoundation.co.uk

www.steamco.org.uk

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Want to know more about the artist that designed this resource? Contact us and we'll happily introduce you!

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**University of
Sunderland**

