London Bridge is Falling Down: Analysing Lines, Angles and Geometric Shapes in Everyday Life

Primary: (ages 7-11)	**Mathematics**

Inspired by the common children's rhyme "London Bridge", students will identify the functions of lines, angles, and geometric shapes and how they work together in complex structures like bridges (e.g. speed/weight distinction, ability to hold weight, and aesthetic judgments). The teacher will provide students with pictures of London Bridge from a number of stages in its history and encourage discussion of how various structural changes have sustained the bridge and its function over time. Students will discuss the possible effects of taking elements of the bridge away or changing the building materials. The lesson can also include a capstone project that allows students to experiment with creating their own bridges in small groups and to engage in discussion with peers to defend the choices they have made in constructing their bridges.

Time allocation	3 lesson periods
Subject content	Identify lines, angles, and geometric shapes as elements of construction. Explore how manipulation of lines, angles, and shapes reinforces or weakens structures.
Creativity and critical thinking	This unit has a **creativity** and **critical thinking** focus: • Identify and question traditional methods of bridge construction • Make connections between mathematical concepts and everyday objects such as bridges • Consider, explain, and evaluate different perspectives on bridge construction
Other skills	Collaboration, Communication

Key words	bridges; lines; parabolas; angles; geometric shapes; viaducts; suspension; arches; engineering; speed; weight

Products and processes to assess

At the highest levels of achievement, students examine the presence of angles, lines and geometric shapes and provide rationales for their various uses through project-based learning. They participate in discussions and model bridges that require them to consider alternative materials and take into account the impact on structures when conditions are changed. Students aim to create a product that reflects clear deviations from known examples, uses alternative theories, and features challenges to the norm.

Teaching and Learning plan

This plan suggests potential steps for implementing the activity. Teachers can introduce as many modifications as they see fit to adapt the activity to their teaching context.

Step	Duration	Teacher and student roles	Subject content	Creativity and critical thinking
1	Lesson period 1	Teacher introduces topic by referencing the history of the story behind the common nursery rhyme London Bridge. Students engage in a discussion around the various construction choices/designs of the bridge and the lines, angles, and geometric structures that have supported the bridge based on blueprints of the bridge at various stages in time. Additionally, students can examine why the presence or absence of different elements have contributed to or taken away from the bridges functionality.	Describing lines, parabolas, and angles and functions	Identifying and questioning historical and conventional methods of bridge construction
2	Lesson period 2	Students discuss the traffic, weather conditions and age of the bridge to guide discussion of why bridges were designed as they were. Three main areas to be discussed include: Ability to hold weight Aesthetic judgment Speed/weight distinction	Identifying, and putting in mathematical language, factors that contribute to the functionality and beauty of bridges	Making connections between other maths concepts and bridge construction
3		Teacher instructs students to draw their own bridge designs for various conditions and functions (pedestrian crossing, local traffic, or highway used for commercial transport) highlighting the key angles, lines, and geometric shapes used for the construction of bridges. Students experiment by conjecturing what the result would be if certain elements were unavailable for use in construction or if they were tasked to create the same product within a reduced budget. As homework, the teacher asks students to bring in local recycled materials for an in-class bridge construction project.	Identifying differences in bridges with different functions and factors that require the reconstruction or redesign of bridges Proposing and justifying, in mathematical terms, own opinion concerning materials that are suitable to model bridges	Generating and playing with several approaches to solve the problem of bridge construction Envisioning how to construct a bridge without access to certain materials
4	Lesson period 3	Teacher reviews past lesson and combines student and class materials for bridge construction projects. Students are divided into small groups of 4-6. Alternatively, materials such as Lego could also be used. Students assess supplies and decide how to construct their bridges with the available materials.	Designing and constructing a sound structure by choosing materials adapted to weight and traffic requirements	Creating a personally novel model of a bridge
5		Teacher asks students to switch groups and have one member of each group explain and justify the group's choices.	Presenting student/ group work on bridge construction	Considering several perspectives on how to approach bridge

	Teacher instructs students to research in groups (2-3 students per group) to identify alternatives to bridges as well as modern/novel techniques for bridge construction. Students present their bridges to their peers and explain the choices they made for the construction of the bridge. Students conduct group research on alternatives to bridges and modern/novel methods of bridge construction.	Comparing students' choices and state-of-the art methods of construction applied by engineers/designers	construction Explaining strengths and limitations of different ways of solving the problem of how to construct a bridge

Resources and examples for inspiration

Web and print

- History of the London Bridge https://en.wikipedia.org/wiki/London_bridge
- Blueprints and pictures of the London Bridge at various stages in history

Other

- Projector, poster board, markers/pencils

Opportunities to adapt, extend, and enrich

- Potential to make links to history (history of London etc.) and technological developments over time (development of different types of material etc.) or to learn about and compare other famous bridges, perhaps from different countries (e.g. Golden Gate bridge, Sydney Harbour bridge, Ponte Vecchio, Tsing Ma bridge etc.)

Creativity and critical thinking rubric for mathematis	•Mapping of the different steps of the lesson plan against the OECD rubric to identify the creative and/or critical thinking skills the different parts of the lesson aim to develop

	CREATIVITY Coming up with new ideas and solutions	Steps	CRITICAL THINKING Questioning and evaluating ideas and solutions	Steps
INQUIRING	Make connections to other maths concepts or to ideas from other disciplines	2	Identify and question assumptions and generally accepted ways to pose or solve a maths problem	1
IMAGINING	Generate and play with several approaches to pose or solve a maths problem	3-5	Consider several perspectives on approaching a maths problem	3-5
DOING	Pose and envision how to solve meaningfully a maths problem in a personally novel way	3-5	Explain both strengths and limitations of different ways of posing or solving a math problem based on logical and possibly other criteria	5
REFLECTING	Reflect on steps taken to pose and solve a maths problem		Reflect on the chosen maths approach and solution relative to possible alternatives	