

1. What is our purpose?

To inquire into the following:

- **transdisciplinary theme**

How the World Works

An inquiry into the natural world and its laws; the interaction between the natural world (physical and biological) and human societies; how humans use their understanding of scientific principles; the impact of scientific and technological advances on society and on the environment

- **central idea**

The properties of construction materials influence the design of buildings and structures.

Summative assessment task(s):

What are the possible ways of assessing students' understanding of the central idea?

Summative: Children are asked to construct a self supporting, weight bearing structure and explain why it remains standing and why it supports the weight it does.

Students will keep a notebook that will include their research and a record of their building projects from start to finish.

Student self-assessment: *Students assessed their own plans, designs and structures, constantly looking for ways to make improvements.*

What evidence, including student-initiated actions, will we look for?

Students are able to identify materials used, properties of materials, structure design, load bearing, anchorage points

Class/grade:

Age group: 7-8 years

Title: Build It

Teacher(s):

Proposed duration: 54 hours over six weeks



PYP planner

2. What do we want to learn?

What are the key concepts (form, function, causation, change, connection, perspective, responsibility, reflection) to be emphasized within this inquiry?

*Key concepts: **form**, connection, causation (Structure has a purpose)*

What lines of inquiry will define the scope of the inquiry into the central idea?

- *Different building materials and their properties*
- *The structure of buildings and bridges*
- *The materials and shapes used in making different stable, weight bearing structures*

What teacher questions/provocations will drive these inquiries?

1. *What materials/shapes are buildings made of? Why?*
2. *What properties do building materials have?*
3. *How have building materials changed over time? (look at origins & uniformity)*
4. *How do buildings stand?*
5. *Which materials make structures strongest? Last the longest?*
6. *Why do we (humans) create all these various structures?*

3. How might we know what we have learned?

This column should be used in conjunction with “How best might we learn?”

What are the possible ways of assessing students’ prior knowledge and skills? What evidence will we look for?

Pre-Unit: *The children collect and bring pictures of bridges and structures to share with each other. This will be an interactive display that can be constantly updated, locations added, materials considered and posted.*

Students will collect various materials to generate a base for vocabulary development and reference for later exploration of materials and their properties (cardboard, metal, Styrofoam, plastic, paper, leather, cloth, wood, plant fibers, etc). * Make sure that students know that different materials can appear in different forms demonstrating different characteristics, e.g. plastic (thin, thick, flexible, or solid)*

Look at the original Seven Wonders of the Ancient World and talk about which ones are no longer standing and why.

What are the possible ways of assessing student learning in the context of the lines of inquiry? What evidence will we look for?

The exploration of collected materials, materials used in the school and our community will allow us to see how.

Through observation we will be able to see how the students become familiar with a timeline of the development of materials and so can look at structures over time in relation to this. Our experiments with the arch, beam bridge, plastic straw structures etc will allow them to explore and talk about structures that are more stable, and factors that influence stability. We anticipate that open ended exploration will raise the issues of stability and use of base, anchorage, connectors etc.

The learning will be recorded through photos and their own self reflections about their learning.

After the visit to a nearby architecture museum, where students will learn about push and pull, and how these forces affect structures, we would expect to see this learning demonstrated first in the construction of the paper strip tower and repeated in their construction of the stick bridge, newspaper bridge and their final structures.

4. How best might we learn?

What are the learning experiences suggested by the teacher and/or students to encourage the students to engage with the inquiries and address the driving questions?

- *Develop class definition of material. Students go for a walk around the local area and discover the types of materials that are used for houses, apartment blocks, roof tops, churches and the overpass. Put up photographs of the town and encourage students to name the various materials they recognize and guess how old the structures are.*
- *Students bring in a picture or a model of a structure or building that they like or know. They research some information about their building and write a paragraph in their journal. Information may include how tall it is, how old it is, what it is made from, where is it located? These structures can be sorted and their location, especially in relationship to geographical elements (e.g. lighthouse on the coast) can be a point for further discussion.*
- *ESL students will be introduced to the unit and asked to bring in photos of bridges from their home town/country to be shared with classmates and used during discussions. New vocabulary will also be introduced: names of materials and tools, adjectives to describe properties of materials, action verbs to talk about function of tools. At different stages during the unit, ESL students will be introduced to some of the scientific terms used in this unit (variables, hypothesis) in the context of discussions and hands-on activities. They will receive support with their experiments write-ups (writing will be scaffolded by using sentence starters).*
- *Ongoing language development – build a class word bank to help with spelling and vocabulary; sort words into categories of buildings and materials; write definitions in their journal e.g. structure, tool, bridge etc.*
- *In small groups, make a 20 cm bridge out of sticks, hemp twine, and rocks. Investigate and explore how difficult it is to use materials in their natural state. Through trial and error, students should come to the understanding that structures are best built with uniform materials. This is the first activity where students must plan, design (sketch) and trial their designs.*
- *Read a play of the Three Billy Goats Gruff in groups (emphasize fluency and expression). Use playground equipment as props for performance. Challenge: build a rope bridge for the Goats in class or at home and see what other materials will help their bridges stand up or be stable for the goats to stand on. Students will present their bridge informally to the class telling how they made it and what tools and materials they used. Extra challenge: can the bridge bear the weight of the three goats? Students will write a procedure of how they made their bridge for the Three Billy Goats Gruff. Include tools and materials, step by step instructions and a diagram of their bridge.*
- *In small groups, make houses out of cardboard. Use various designs and methods, recording each process. After at least 5 trials, give students the opportunity to build cardboard house with the same sized card, cut with tongue and groove notches. Students should determine which trials were most successful and reflect on why.*
- *Fold, Twist, Roll challenge: Can you lift another student (seated on the floor) off the ground using newspaper? Students will each get 10 sheets of newspaper per trial. Firstly they will investigate how strong a sheet of newspaper is when folded. Next, they will trial twisting a sheet of newspaper and finally rolling a sheet of newspaper. Students should then combine methods to see which provides the strongest "rope" of newspaper. A combination of all three should allow one student to lift another from a seated position. This is a good segue into getting visiting expert in to talk about how pressboard and plywood is made and why and where it is used around the school.*
- *Three Little Pigs experiment: students build three structures based on those of the pigs (use real straw, sticks and LEGO for bricks). Students should test the sturdiness of the structures using a hair dryer and 25g weights.*
- *Field trip – led by the German teacher – to the architecture museum to look at buildings and structures from Stone Age through to modern day. Opportunity to design and make a stable structure from cardboard strips. Forces, push and pull, will be introduced and explored as part of a hands-on workshop at the museum.*
- *Field trip to a nearby mathematics museum. While there, build a stick bridge with no supports (DaVinci Bridge) and an arch bridge. Experiment with 2-dimensional and 3-dimensional shapes. On return to school, research beam, arch and suspension bridges and keep a record in journals. Students create their own comparison table to compare the differences and similarities of various structures.*
- *A local civil engineer who works for an international bridge building company will give a presentation.*
- *Challenge: in pairs, using what they have learned about structures, the students will build their own newspaper bridge over four sessions. Students will choose from a limited set of materials, (e.g. newspaper, string, cartons) to build their structures with the goal of holding a certain weight. Their structures will be tested and the students will keep a record of the process in a work journal that includes an overall plan, predictions, materials, daily notes, changes made to the structure over the four sessions, and final results.*

What opportunities will occur for transdisciplinary skills development and for the development of the attributes of the learner profile? *Transdisciplinary skills – thinking, social, self-management, communication, research (see box 7 for details); Learner profile – thinker, knowledgeable, reflective, communicator (see box 7 for details).*

5. What resources need to be gathered?

What people, places, audio-visual materials, related literature, music, art, computer software, etc, will be available? Pictures of bridges and structures, sweets and cocktail sticks, square beer mats, dominoes, Hundreds, Tens and Units material, straws, wood, cork, paper, rubber, foam, sawdust, plastic, newspaper, string, National Geographic Videos from Megastructure Series, Hardhatting in a Geo-World by Aims Education Foundation, Under Construction by Aims Education Foundation, Tangrams and book 3 pigs, one wolf and 7 magic shapes, building sets (lego, building straws, magnetic blocks), Seven Wonders of the Ancient World books or websites, scales, rulers and meter sticks.

Books for ESL students – *Building Bridges* by David Gover; Fairy tale of *The Three Billy Goats Gruff* (with cassette); Books for class use - *Building the skyscraper* by J. Korman, *7 Wonders of the world - Kids Discover*, *Build your own model house* by V. Fawcett & R. Hunt, *Die Baustelle* by Philippe Biard, *Building a house* by V. Fawcett, *How a House is built* by G. Gibbons, *Bridges to cross* by P. Sturges, *Cross a bridge* by R.A.Hunter, *The greedy triangle*.

How will the classroom environment, local environment, and/or the community be used to facilitate the inquiry? *Visiting speakers, e.g. civil engineer; field trips to architecture museum and mathematics museum; walking tour of school and local community.*

6. To what extent did we achieve our purpose?

Assess the outcome of the inquiry by providing evidence of students' understanding of the central idea. The reflections of all teachers involved in the planning and teaching of the inquiry should be included.

It took a while to develop the vocabulary that would enable individual students to make full description of the properties. The students manipulated their chosen materials appropriately to create and support their structures in their summative assessment. This was clearly an indicator of applying their understanding about the properties and uses of materials. The children talked about the materials used in real structures and why the materials used were appropriate, in discussion the pictures we provided as stimulus in the classroom.

How you could improve on the assessment task(s) so that you would have a more accurate picture of each student's understanding of the central idea.

In the presentation of the assessment, students should have the opportunity to reflect on their individual ideas and plans before meeting with their group. This way, everyone comes to the meeting with ideas to share. There would still be a group outcome, but there would be evidence of individual thinking too. We could video tape each group's bridge challenges and watch the children's progress.

What was the evidence that connections were made between the central idea and the transdisciplinary theme?

The trip to the architecture museum and the manipulation of different structures/shelters over time enabled them to make links between materials, shelters/structures and people and time. This is also where they first met the idea of forces acting upon structures and the need to consider this when building.

7. To what extent did we include the elements of the PYP?

- **What were the learning experiences that enabled students to:**
 - develop an understanding of the concepts identified in "What do we want to learn?"
 - demonstrate the learning and application of particular transdisciplinary skills?
 - develop particular attributes of the learner profile and/or attitudes?
- **In each case, explain your selection.**

Concepts

Form – developed through the exploration of materials, visit to architecture museum, video of structures, research of non-fiction books

Connection – developed through visit to architecture museum, practical building activities/challenges, walking tour of the school and local community to look at use of particular materials in particular structures

Causation – developed through push and pull work at the architecture museum, learning about change over time in structures and building, location, availability of materials.

Learner profile

Thinkers: this was a great unit to develop this attribute. The students engaged in lots of thinking through designing structures and coming up with solutions to each of the challenges. There was ongoing reflection and changing of plans. The summative assessment challenge really showed each student's thinking process.

Knowledgeable: students became knowledgeable about structures, and developed some sense of history and the timeline of particular materials. The research (visiting speakers, reading) gave them access to knowledge of factors that need to be considered for certain constructions (e.g. geographical conditions, suitability of materials). A strong connection was made during integrated German (visit to architecture museum) with increased awareness of time periods and how different generations build upon the work and learning of previous peoples.

Communicators: students used many different modes of communication.

Reflective: ongoing opportunities for reflection throughout the unit (as part of the individual, pair and group challenges). Reflecting on their work was part of the summative assessment.

PYP attitudes

A big unit for demonstrating student **enthusiasm** - they were really engaged in this unit; **confidence** developed through the unit especially as their understanding of the central idea and lines of inquiry increased; **Curiosity**, lots of hands on investigation and exploration, they were also very **creative** as there was lots of **cooperation**.

Transdisciplinary skills

Thinking skills: synthesis – creating and designing bridges; evaluation – making judgments or decisions about their bridges.

Social skills: Accepting responsibility for tasks, respecting other's ideas, cooperating, resolving conflict if there is a problem, group decision making.

Communication skills: listening, speaking, reading, writing, presenting.

Self-management skills: organization, planning and carrying out activities effectively.

Research skills: collecting data and gathering information about bridges and what makes them strong; recording data by note taking from watching documentaries and listening to visitors talk about bridges and buildings; presenting findings - children report back about what they have learned in relation to bridges.

8. What student-initiated inquiries arose from the learning?

Record a range of student-initiated inquiries and student questions and highlight any that were incorporated into the teaching and learning.

Student questions

What are we going to build out of all the materials we collected? Out of which materials are most bridges built? Can you build a bridge out of mud? What materials do you need to make a mud house?

How many bridges are made of stone? What materials do you need to build a bridge?

How many years on earth does it take to think about a good structure so that it doesn't fall down?

How many years does it take to carve a statue out of stone or marble? Are there any bridges made of glass? Are there any bridges made of marble?

How long does it take to make a bridge?

How many big bridges are there in the world? How long does it take to build a triple deck bridge?

Can you build a bridge out of grass? What materials are necessary to build a triple deck bridge?

Can houses be built on bridges? Can bridges be made out of trees? Why do bridges have different shapes? Why is there gravity? Why did the Vikings build out of trees when it wouldn't last long?

At this point teachers should go back to box 2 "What do we want to learn?" and highlight the teacher questions/provocations that were most effective in driving the inquiries.

What student-initiated actions arose from the learning?

Record student-initiated actions taken by individuals or groups showing their ability to reflect, to choose and to act.

Several students also inquired at home and built bridges, structures and towers of various shapes and sizes to share with the class. Students were involving parents in discussions of bridges as they drove to school. Children are still bringing in and testing bridges at home after the assessment is complete.

9. Teacher notes

Physical education:

Humans make structures using different materials and different shapes. Our bodies can make similar shapes that when positioned strategically they are able to form stable bases (with structural similarities) that can carry and bear weight.

This unit exposes the students to a variety of gymnastic skills (on the floor) Students improve and expand their gymnastic skills: body control, balance and spatial awareness. They learn how to bear the weight of peers by making stable and broad bases. See PE planner for details.

Music:

*A link was made to this unit through the concept of **form** by exploring musical compositions.*

Visual arts:

3D sculpture creativity.

Mathematics:

This is the most valuable unit for teaching 3d shape and our shape and space learning objectives.

Reminder for next time:

The architecture museum workshop was essential to helping students develop their understanding further. The students really got to explore the change of structures over time and consider which forces influence the design of structures. This should happen before the civil engineer comes to discuss the bridges that his company builds as it helped to front load the students.

Book the museum early.

Agreed definitions for "material" and "structure" were useful in helping teachers and students to decide the scope of activities.