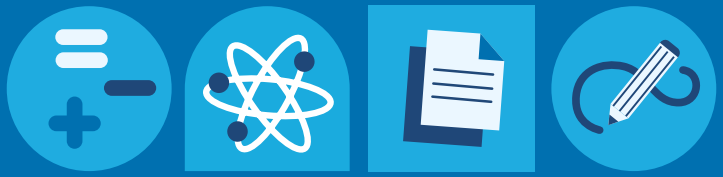
Suitable for 3-7 years

- [x] Solo
- [x] Pairs
- [ ] Groups

Doug's activity

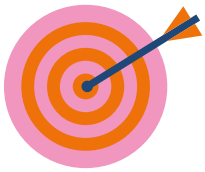
Introducing engineering Nuts & bolts

How to guide



Doug's activity

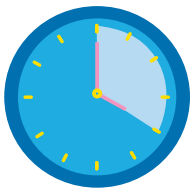
Introducing engineering Nuts and bolts



Aim

These activities introduce children to real tools, invite them to explore objects by taking them apart and encourage the construction of creations in response to engineering challenges.

Depending on the exact nature of the activity. Exploring nuts and bolts can be done individually, in pairs or groups. Deconstructing old items is best done supervised in small groups. Building new creations can be done individually or in pairs.



Time required

Open-ended play for nuts and bolts, tinkering ~20:00 minutes though can be extended

Materials and equipment

For nuts and bolts: a set of mixed nuts and bolts, washers optional

For a tinkering table: there are two approaches that you could select:

- Taking apart real items, e.g. old computers. For this you need old, small appliances, e.g. computer or keyboard (cables removed), or broken mechanical toys and real tools like screwdrivers and pliers (child-size)
- Using a range of materials for building in response to engineering challenges. For this you could use items from the below list.

Note: this is not an exhaustive list so you could add more to your collection as you find things. Neither do you need to provide everything but a good mix of different materials is useful.

- **For building:** craft sticks, cardboard tubes, drinking straws, cardboard, pipe cleaners, lids, paper cups and plates, scraps of wood, chopsticks, corks, recycling items like old plastic containers and milk bottles...
- **For connecting:** string, thread, glue, Sellotape, staples and stapler, clothes pegs, rubber bands...
- **For decorating:** pom poms, googly eyes, feathers, glitter, beads and buttons...

Health and safety

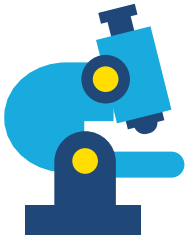
Supervise use of small parts, especially if there is any risk of children putting them in their mouths; take care to demonstrate how to use tools safely and monitor their use.

Instructions

Set out the nuts and bolts and wait to see how the children interact with them.

Prompt questions

- Can you sort these by size?
- How many nuts can you fit on one bolt?
- Can you attach bolts together?



How does it work?

Engineers need to use nuts and bolts to assemble different parts and build structures. They let us take things apart again for cleaning or to check how things are working or to

tighten up the connection if necessary. Choosing the right type and size of nuts and bolts is important to ensure things are strong and stable. Really really small nuts and bolts are used in electronics, like laptops or kitchen appliances and even in glasses that people wear. Large nuts and bolts are used in big construction projects, e.g. the Eiffel Tower (find out more about different engineering structures in our Structures Activities with engineer Fionah) and bits of machinery like pumps.

See photos below of some big nuts and bolts:

Historically, the biggest bolt ever made was in 1967 by the Penrith Engineering Works company in Scotland. They were enormous - 27′ 4″ long (8.3m), 4′ 2″ diameter (1.27m), weighing 12.6 tonnes. 60 of them made for SWISSOIL, in an experiment to increase the capacity of oil tankers by bolting two of oil tankers together. The experiment ended in failure - the force of the sea and the unsynchronised tankers ripped the bolts apart one by one.

Extensions

- See where you can spot nuts and bolts in things around you, e.g. spectacles, electronics, furniture etc – this can lead into tinkering
- Construction with nuts and bolts and materials, e.g. pieces of wood with different size holes
- Link to literacy and spelling. Write letters/words on your nuts and bolts, e.g. uppercase letters on bolt and lowercase letters on nut for the youngest children and short words, like cat, dog, tub, rug, on the bolt and letters on the nuts for older children. Ask them to match the letters or spell the words.

Tinkering Instructions

1. Bring something to be deconstructed. Ask the children to observe it and guess what might be inside. Take it apart and explore what it is made of and how it is put together.
2. Challenge the children to build their own creations. Set out all the materials with space for building. This could be a undirected build with them developing their own creations or you could set-up and motivate a challenge (see some ideas below). Think about how the children could test their creations, e.g. for Make it Roll provide a ramp for testing.

Example challenges

Read the book **Dear Zoo** and challenge the children to build a container to transport their favourite animal home from the zoo

Read the book **The Three Little Pigs** and challenge the children to build a house that cannot be blown down

Read the book **The Tale of Peter Rabbit** and challenge the children to build a fence to help Mr McGregor keep Peter out of his garden or to build a trampoline to help Peter escape

Read the book **How to Lift a Lion** and challenge the children to find a way to lift a lion

Note – you might need some extra resources for the above, e.g. a lion to lift or a selection of animals for Dear Zoo

Or try challenges like Make the Tallest Possible Structure, Make Something that Rolls, Make Something that Floats/to Transport People over the Water (Playmobil, Duplo or Lego characters or a Doll), Make a Bridge Strong Enough for a (Toy) Train/Car to Cross, Make a Wrecking Ball to knock down a Tower...

You could also try ideas from some of our other activities

- **Make a noisemaker and a noise reducer** (Antonio)
- **Make a Rocket** (Adah)
- **Make a Plane** (Sarah)
- **Make a Wind Turbine** (Allison)

The above all have detailed instructions but why not try your own design. You could also Design a Robot (Emilyann) or a Space Rover (Sara) though you might not be able to test these!

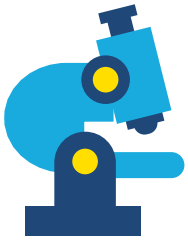
Prompt questions

Provide information to support designs, e.g. for Make Something that Rolls the information that either the axle needs to spin or the wheels need to spin freely

Encourage testing – e.g. for Make Something that Rolls try the car on the ramp and see what happens

Ask how it worked – e.g. for Make Something that Rolls why did this car slide and that one roll?

You could also place out some examples made of different materials for the children to observe and explore, e.g. for Make Something that Rolls other cars and items that roll



How does it work?

Taking apart real items allows children the opportunity to use real tools and to explore everyday objects around them to see how they are made. Utilising a range of materials to craft their own creations in response to an engineering challenge allows them to follow an engineering design cycle (print out our design cycles guides as posters or show on the Smartboard to support the process), e.g. explore-create-improve (for the younger ones) or ask-explore-plan-create-improve (for the older ones) and turns tinkering into engineering. Encouraging testing and redesigning promotes a higher level of engineering behaviours.

Definitions

Tinkering – using stuff, e.g. exploring materials and objects

Making – using stuff to make stuff

Engineering – using stuff to make stuff that does stuff

To read more about this download NAEYC's pdf: 'What You Need to Know About Tinkering'.

Further extensions

You could add more materials to your tinkering station. Think up new challenges. Can the children identify any problems which need to be solved? Read Making and Tinkering in STEM by Cate Heroman for more ideas of making and engineering challenges linked with stories.