EA jnr club

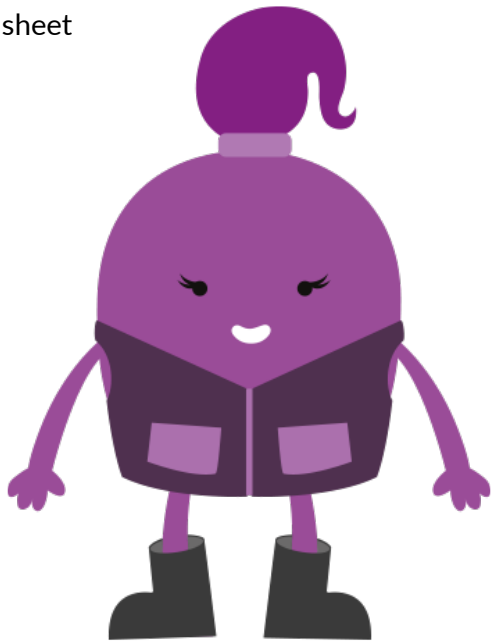
Lower Primary

TEACHER RESOURCE KIT

Rebuild a community

This guide includes:

- Lesson ideas
- Project instructions
- 'Energy for my community' activity sheet
- 'Environmentally-friendly city' activity sheet
- 'Safe and environmentally friendly homes' activity sheet
- 'Safe and efficienty traffic systems' activity sheet
- Know Want Learnt (KWL) Chart
- Think Want Learnt How (TWLH) Chart
- 'What natural disaster am I?' Activity sheet



ENGINEERS AUSTRALIA

Rebuild a community: *lesson ideas*

Science

- Students to complete the **'Energy for my Community'** activity sheet.
- Students to discover the various purposes of dams/reservoirs for human use such as water supply, irrigation and flood management. (*For more information, refer to the 'Construct a catchment' EngQuest project.*)

Technologies

- Students to brainstorm various materials used to construct buildings, bridges, roads etc. Discuss which of these materials students think would be suitable for building in areas prone to floods, fire, earthquakes or cyclones?
- Students to complete the **'Environmentally-friendly City'** activity sheet.
- Students to complete the **'Safe and Environmentally-friendly Homes'** activity sheet.
- Students to complete the **'Safe and Efficient Traffic Systems'** activity sheet.

Mathematics

- Students to survey classmates and family members to find out what people think are the priorities when rebuilding a community after a natural disaster. Graph the results as a class.
- Students to consider the use of shapes in building construction. Which shapes give buildings the most strength? Students to design a building using only shapes that will provide strength.
- In teams, students to construct a bridge using a range of materials (*e.g. ice cream sticks, matchsticks, Plasticine, sticky tape, newspaper, straws, and/or string*). Allocate a cost to each material and then students can attempt to calculate the total cost of their bridge. (*For more information, refer to the 'Construct a straw bridge' EngQuest project.*)

English

- Students to create a class timeline of major natural disasters that have occurred in Australia over the last 10 years.
- Students to complete the **'KWL Chart'** or **'TWLH Chart'** activity sheet.
- Students to select a newspaper/magazine article focusing on a natural disaster. Share with the class what happened and discuss how the people involved were affected.
- Students to brainstorm as many humanitarian engineering words as possible, and then create a class word wall on which to record these words. Students will add to this as they learn new words.
- Invite a local humanitarian to talk to the class about the work that they do.
- Students to create an illustrated non-fiction book, explaining what humanitarian engineers do. Use the
- KidPix program, a book-making app or just cardboard and paper.

Humanities and Social Sciences

History

- Students to discuss disasters that have affected their local communities. How did engineers respond?

Geography

- Students to choose a type of natural disaster and discover what effects it has on buildings, surrounding landscapes, vegetation and native wildlife.
- Students to discuss what community and private buildings and infrastructure need to be rebuilt after a natural disaster.
- Students to participate in the **'What Natural Disaster am I?'** activity (*printable clue sheets can be found with the activity sheets*).
- Students to learn about a local charity or organisation which helps to promote human welfare, including the services they offer to communities following a natural disaster. How does this charity contribute to their local community?

The Arts

- Students to design a poster that encourages people to volunteer their time to help people in need.
- Students to create a collage relating to humanitarian work using magazine pictures.

Health and Physical Education

- Students to discuss why it is important to help others. What are the benefits?
- Students to make a list of basic human needs. How different are our basic needs from those of people in other countries? Compare and discuss.
- Students to think of a time when they have helped someone. Write a recount of the experience, explaining what happened and how they felt.
- Students to investigate the concept of being a 'humanitarian' or 'hero'. What are the traits that such people possess? Whom would they consider to be a 'humanitarian' or 'hero' and why?

Languages

- Students to write messages of hope in another language for people affected by natural disasters.

Construct a catchment: *Project instructions*

Important safety information

Allow plenty of time to discuss any safety precautions that are essential when constructing or testing the model. These could include not using water near electrical equipment or outlets, avoiding the slip hazards of spilt water, safe handling of any tools (e.g. sharp blades) that might be used in the activity and ensuring that any operating parts of the model are powered by batteries or solar cells (not mains operated).

As a class, discuss how students can keep themselves and others safe. These ideas should be presented on a class poster and displayed in the classroom. All students should agree with these rules before starting and the safety precautions and guidelines must always be observed.

Getting started - research activities

- Students to participate in the 'Rebuild a community' lessons and complete the associated activity sheets.
- Students to investigate natural disasters and how they affect communities.

Engage

The purpose of these engage activities is to encourage students to think about what makes a community and identify the people in our community who help us.

Brainstorm activity

Students to brainstorm what makes a community. Possible topics for discussion include:

- People (e.g. police officers, students, teachers, nurses)
- Buildings (e.g. houses, schools, hospitals, libraries)
- Culture, entertainment and recreation (e.g. festivals, parks, sporting events)

After the brainstorm, students to illustrate their 'ideal community', including the elements that they consider to be most important.

Who helps us in the community?

Students to investigate people in the community who help us. This investigation could take the form of:

- Reading big books
- Guest speakers
- Library research time
- Discussing personal experiences

Imagine a community that has been affected by a natural disaster. Which people in the community would help after a disaster and how? This is where the role of humanitarian engineers should be introduced. To expand on this theme, some real-life examples of past natural disasters could be discussed.

Explore

The purpose of these explore activities is to find out what students know about one particular natural disaster and how it affects communities, and to encourage them to think about the priorities for rebuilding after the disaster has occurred.

Brainstorm activity

Students to brainstorm the natural disaster.

What do students know about:

- Cause/s of this event
- How this event might affect or damage communities
- When/where this event has happened before
- The precautions that can be taken to protect people and places before, during and after this event
- The people that respond to this event when it occurs.

Planning the priorities

In this activity, as a class, students brainstorm which elements of a community that has been damaged by the natural disaster will need to be rebuilt. Write student responses on separate cards. Then, in small groups, students will order these cards from what they consider to be the most important to the least important.

As a guide, the elements that should be included in a rebuilt community are outlined below:

Buildings	Services	Infrastructure	Environment
Houses	Electricity	Roads	Living things and their environment
Shops	Clean drinking water	Railways	
Factories	Fuel	Bridges	
Hospitals	Sanitation and safe waste disposal	Ports	
Schools		Airports	

At the end of the activity, the groups will share their opinions with the class and explain why they put the priorities in that particular order.

From this activity, the class will decide on a set of priorities that will form the basis for the structures and features to be included in their rebuilt community model.

At the end of this phase, students can choose, or be assigned, the type of building or piece of infrastructure that they will construct for the class model. Students will be told that they will be taking on the role of humanitarian engineers to plan, design and construct a rebuilt community.

Explain

The explain phase allows teachers to work with students to extend the science understandings of the concepts that have been explored. Students will investigate building materials with a view to building a safer community.

Which building materials?

Students to draw some preliminary designs of their building or piece of infrastructure, with the understanding that they can use any building materials they wish. Their designs must be labelled to indicate which building materials are being used.

Testing building materials

In this activity, students will be testing the 'disaster-resistant' capabilities of different building materials. Provide students with a range of materials (*e.g. wood, plastic, particle board, bricks etc.*) to be tested under different conditions. These could include prolonged exposure to the sun or water, extreme wind gusts (*created using fans*) or vigorous shaking. Materials could also be tested for sustainability principles such as their insulation properties.

Students should record the results of these experiments in a science journal.

Once the experiments are concluded and the results recorded, students can discuss how the various materials reacted under different conditions. Teachers should then pose the question "how do the results of our experiments affect the choices we make when choosing building materials?"

Students can then revisit their initial designs and make any necessary changes to the materials they selected, to ensure that the new community is safer.

Important note

It is not recommended that students test for fire proof capabilities and they must be supervised by an adult at all stages of testing.

Risk assessment and risk management

Depending on the capabilities of your students you may wish to discuss the principles of risk assessment and risk management.

In real-life disaster situations, a significant element of the rebuilding process is risk assessment and management. When calculating the level of risk, two things are taken into account:

1. The consequences
   If the event happens, how much harm could potentially be done? The consequences of an event in a remote and unpopulated area will be different than if the same event occurred in a densely populated area.
2. The likelihood
   How likely is this event to happen? If the event might only occur once every one hundred years or less, the risk level would be low compared to an area where the event might happen every five years.

There are a number of ways of controlling risks.

- Eliminate or remove the risk
  For example, we could remove the risks from tsunamis if nobody lived in low-lying coastal areas. However, for many people in the world, this is not a practical solution as they rely on these areas for their food supply or income.
- Substitute safer alternatives
  For example, when building houses in earthquake-prone areas use a light-weight material for roofing, rather than heavy slabs that might collapse and cause injury.
- Use engineering controls

These could include levees, dams, reinforced buildings and height limitations.

- Administrative controls
  These could include erecting warning signs in hazard-prone areas, or introducing regulations that indicate where buildings should be constructed.

When you reach the construction phase of your project, you should consider how students can apply some, or all, of these principles to their rebuilt community to ensure that it is safer than the original one.

Some examples of how you might incorporate risk assessment and management into the project are:

- Including a river system in the landscape of the model. This will encourage your students to think about flood and/or bushfire risk management.
- Requiring students to include trees and other plant life in their model. Students will need to consider building placement in relation to these if the area is prone to bushfires or earthquakes.
- Ensuring that students assess the design of their buildings or infrastructure and the materials they use for construction for possible risks.

Elaborate

In this phase, students will apply their knowledge and understandings of the properties of building materials whilst planning, designing and constructing a model of a rebuilt community.

The student teams will be contributing one element of the community (e.g. one building or one piece of infrastructure) to one large class model.

All steps of the design, construction, testing and critiquing stages should be recorded by the students. Students should be encouraged to include a variety of ways of recording their information, such as journals, labelled diagrams, digital photos, story boards and so on.

Planning and design

Now the students are ready to revisit their initial plans and complete the design of their contribution to the model. At this point, the students will decide on the actual materials to be used in the construction of their building/infrastructure, as well as what these materials will represent (*e.g. cardboard painted to look like bricks for the walls of buildings*).

Extension options

1. Students to consider the principles of sustainability in their designs and construction (for more information about sustainability, view the 'Primary projects - Rebuild a community' project instructions).
2. Students to include a working/moving part in their design.
   For example:
   - Solar panels
   - Building insulation (that can be tested)
   - Lights
   - Wind turbines
   - Water wheels
   - Opening bridges
   - Dam or catchment

Limitations for the project

Students need to be made aware of the following limitations before the project begins:

- The model is to be constructed from readily-available or 'found' materials, or items that can be easily and cheaply purchased in a hardware store or supermarket.
- The model is to be well designed and constructed.

Construction

The constructions are to be stronger/safer than the ones destroyed by the disaster. The elements that make the building/infrastructure strong must be labelled.

Once the planning and design are complete, students can begin to construct their models.

For more information and tips on constructing these models, see the project instructions in the teacher sections of this website for the following projects:

- Construct a model house
- Construct a catchment
- Construct a solar cooker
- Construct a straw bridge
- Construct a newspaper dome

Materials for project

Buildings and infrastructure

Students are to create their rebuilt community model out of readily-available or recycled materials, or items that can be purchased cheaply from a hardware store or supermarket such as:

- cardboard
- plywood
- Plasticine
- papier mâché
- clay
- polystyrene
- plaster of Paris
- straws
- ice cream sticks

In choosing their construction materials, students will need to consider the properties of different materials and select those that are most appropriate.

Some considerations about the properties of materials should include the following:

- Strength - the structure needs to be strong enough to support its own weight and to function without breaking.
- Size and shape of available materials.

Model base

Materials such as particle board can be used for the base, with papier mâché, clay, Plasticine, polystyrene, or plaster of Paris used to create a topographical land surface. However, remember that the inclusion of some of these in a solid model will make it very heavy and difficult to transport. It may also use very large quantities of materials.

It is suggested that the topography can first be shaped using materials such as chicken wire or fly screen, supported as needed above the base board with glued-on pieces of timber. The land surface can then be completed by moulding the clay, papier mâché, plaster of Paris etc. over the wire frame.

Evaluate

In this section, students will reflect on their learning, and present their contribution to the class model to their peers. The presentation could take the form of an oral report and should include:

- Explanation and justification of the building materials used.
- Explanation of how the building/infrastructure has been designed to be safe.

Peer assessment

If risk assessment and management has been discussed with the students, they could be asked to perform a 'risk management assessment' of another team's contribution to the class model using the principles of risk assessment outlined in the 'Explain' phase of this project.

Testing the models

Depending on the type of disaster chosen, it may be possible to 'test' the strength and resilience of the rebuilt community under disaster-type conditions.

For example:

- If the students have worked to earthquake-proof their community, the strength of the new buildings can be tested by shaking the model vigorously.
- If the students have worked to flood-proof their community, the model could be tested by adding water.
- If the students have worked to hurricane-proof their community, the model could be tested using 'wind' generated by fans.

After the models have been tested, students should be given the opportunity to reflect on how their models performed under 'disaster conditions' and discuss any improvements that could be made.

Assessing the projects

On completing the construction and the testing of their models, students should be engaged in assessing the successes of their projects. They should consider:

- What have they learned whilst doing the project?
- What else would they like to learn about natural disasters or humanitarian engineering?
- What would they do differently if they undertook the project again?

Energy for my community

Name: _____

Humans use huge amounts of energy to power our homes and transport systems.

Find information about the following types of energy sources.

Energy source	What is it?
Solar power	
Wind power	
Hydropower	
Gas	

Which energy source would you use in your community and why?

Environmentally-friendly city

Name: _____

Design an environmentally-friendly city centre of the future. Include the following:

- Transport – roads, bridges
- Food and water supplies
- Energy – Electricity? Solar? Wind?
- Housing
- Schools and hospitals

Draw and label your city centre.

Safe and environmentally-friendly homes

Name: _____

Structural engineering teams investigate how homes and buildings can be planned and built in the best possible way. They think of ways to make houses more environmentally-friendly and safer for people who live in disaster prone areas.

Design and label a house that is both environmentally-friendly and safe.

Safe and efficient traffic systems

Name: _____

Transport engineering teams plan, design, construct and manage traffic systems, including roads and paths, which are essential for us to move from one place to another.

Draw and label the following examples of traffic systems that help people move around.

Traffic lights	Zebra crossing
Roundabout	**Bridge**

Know Want Learnt (KWL) Chart

Name: _____

What I **KNOW** about humanitarian engineering	What I **WANT** to know about humanitarian engineering	What I have **LEARNT** about humanitarian engineering

Think Want Learnt How (TWLH) Chart

Name: _____

What we **THINK** we know about humanitarian engineering	What we **WANT** to know about humanitarian engineering	What we have **LEARNT** about humanitarian engineering	**HOW** we learnt it

What natural disaster am I?

On the following pages you will find a series of clue cards for five types of natural disasters.

The activity can be completed as a whole class, or in small groups, and may be approached in one of the following ways:

1. The clues can be read aloud one at a time, in numerical order, to see how quickly the correct natural disaster can be identified; or
2. Students can set out all the cards and consider the clues to identify the natural disaster.

After participating in the activity, students should be encouraged to choose a natural disaster, create their own set of numbered clues and test their peers.

It is recommended that these cards be printed in colour to make it easier to keep the sets together and laminated for durability.

Solutions

Volcanic Eruption	Green cards
Earthquake	Yellow cards
Bushfire	Blue cards
Cyclone	Purple cards
Flood	Red cards

What natural disaster am I?

Volcanic Eruption

1	Possible loss of life	7	Heat is always involved
2	Property may be destroyed	8	Cannot be prevented
3	Can last for weeks	9	Some are explosive and some are not
4	Can occur at any time of the day or year	10	Causes permanent changes to affected landscape
5	Likely to cause food shortages	11	Can disrupt air travel for days
6	Can often be predicted by scientists	12	Is visually spectacular

What natural disaster am I?

Earthquake

1	Possible for major loss of life	7	It happens a lot, but major events are rare
2	Can occur at any time of the day or year	8	Major events can cause fires
3	May cause major disruption of services	9	Cannot be prevented
4	Much more likely in particular areas	10	Scientists monitor it all over the world
5	Heat is not involved	11	Structural damage to buildings is likely
6	Difficult or impossible to predict	12	Can sometimes cause tsunamis

What natural disaster am I?

Bushfire

1	Possible for loss of life	7	Usually occur in the afternoon
2	Usually causes loss of property	8	Can often be prevented
3	Unlikely to cause disease outbreaks	9	Has a long-term effect on the community
4	Does not permanently change affected landscapes	10	Can be caused by human activity
5	Has a long-term impact on the environment	11	Lack of water is often a problem
6	Road transport is difficult or impossible during and immediately after the event	12	Usually happen in summer

What natural disaster am I?

Cyclone

1	Possible for major loss of life	7	Cannot be prevented
2	Causes destruction of buildings and crops	8	A lot of water is involved
3	Disease outbreaks likely to follow	9	Are usually predicted before they occur
4	Fire is not usually involved	10	Extreme winds involved
5	Has an immediate effect on the environment	11	Flooding may follow
6	No permanent change to landforms	12	Begin over the ocean and tend to weaken when they hit land

What natural disaster am I?

Flood

1	Happens any time of the day	7	Food crops are often destroyed
2	Destruction of property is likely	8	Can be slow or happen suddenly
3	Potential for loss of life	9	Can last for days
4	Often predictable	10	Major disruption to transport
5	Can be partly controlled by humans	11	A lot of cleaning up after the event
6	Happen as a result of world weather patterns	12	Great amounts of water involved