STEM – Three Little Pigs design challenge

Foundation–Level 2



**Disclaimer:** It is the responsibility of the school to ensure that duty of care is exercised in relation to the health and safety of all students undertaking activities. In this unit of work, particular consideration should be given to ensuring adequate supervision when students are using scissors or a hairdryer.

Authorised and published by the Victorian Curriculum and Assessment Authority
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Overview

**Unit of work:** Three Little Pigs design challenge

**Levels:**  Foundation–2

The achievement standard is at Level 2 for all content in this unit of work.

**Approximate time:** 5.5 hours

In this learning sequence, students use the story of the Three Little Pigs to investigate the characteristics and properties of materials, and the suitability of materials for a variety of uses. Students conduct investigations into the characteristics and properties of materials, and they use their findings to inform the design and production of shelters for the Three Little Pigs that will withstand the ‘huffing’ and ‘puffing’ of the Big Bad Wolf*.* Students reflect on the findings of their investigations and begin to pose questions, make predictions and perform simple observations of investigations.

**What makes this unit have a STEM focus?**

This unit of work incorporates content from:

* Design and Technologies
* Technologies Contexts*,* Materials and technologies specialisations
* Creating Designed Solutions, Producing
* Science
* Science Understanding, Chemical sciences
* Science Inquiry Skills, Questioning and predicting and Planning and conducting

|  |  |  |
| --- | --- | --- |
| **Learning area** | **Design and Technologies**  | **Science** |
| **Levels** | Foundation–2 | Foundation–2 |
| **Strand** | Technologies Contexts | Creating Designed Solutions  | Science Understanding  | Science Inquiry Skills |
| **Sub-strand** | Materials and technologies specialisations  | Producing  | Chemical sciences | Questioning and predictingPlanning and conducting |
| **Content Descriptions** | Explore the characteristics and properties of materials and components that are used to create designed solutions [(VCDSTC017)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSTC017)  | Use materials, components, tools, equipment and techniques to produce designed solutions safely [(VCDSCD020)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSCD020)  | Objects are made of materials that have observable properties [(VCSSU044)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU044)Everyday materials can be physically changed or combined with other materials in a variety of ways for particular purposes [(VCSSU045)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU045) | Respond to and pose questions, and make predictions about familiar objects and events [(VCSIS050)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSIS050)Participate in guided investigations, including making observations using the senses, to explore and answer questions ([VCSIS051](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSIS051)) |
| **Achievement Standards** | By the end of Level 2 ... With guidance, students create designed solutions for each of the prescribed technologies contexts … Students create and evaluate their ideas and designed solutions based on personal preferences … Following sequenced steps, students demonstrate safe use of tools and equipment when producing designed solutions. | By the end of Level 2, students ... describe the properties, behaviour, uses and the effects of interacting with familiar materials and objects … They identify and describe the changes to objects, materials …Students pose and respond to questions about familiar objects and events and predict outcomes of investigations. They use their senses to explore the world around them ... |

Equipment and resources

* picture storybook of the Three Little Pigs
* building blocks such as LEGO or wooden blocks
* hairdryer
* scissors
* sticky tape
* range of different types of materials, such as
* cardboard
* hay or straw
* icy pole sticks
* leaves
* paper straws
* small sticks or bark
* wooden skewers
* [‘STEM: Three Little Pigs design challenge’ resource package](http://fuse.education.vic.gov.au/?F78SBM) of curated resources and information on materials used in houses
* ‘Materials testing and observations’ template ([Appendix 1](#Appendix1))
* ‘Shelter testing’ template ([Appendix 2](#Appendix2))
* ‘Student reflection and self-evaluation’ template ([Appendix 3](#Appendix3))
* ‘Teacher assessment rubric’ ([Appendix 4](#Appendix4))

Preparation

Before commencing this unit of work:

* examine the resources provided in [‘STEM: Three Little Pigs design challenge’ resource package](http://fuse.education.vic.gov.au/?F78SBM), and print or display visual resources for class discussions
* print copies of the ‘Materials testing and observation’ template ([Appendix 1](#Appendix1))
* print or display the ‘Shelter testing’ template ([Appendix 2](#Appendix2))
* print the ‘Student reflection and self-evaluation’ template ([Appendix 3](#Appendix3))
* examine and become familiar with the ‘Teacher assessment rubric’ ([Appendix 4](#Appendix4))
* collect a wide range of materials to support a range of student designs. A diverse range of production resources is recommended, to support creativity and innovation in shelter design. This will also support student investigations of the characteristics and properties of materials.

Occupational health and safety

Teachers should be familiar with the Victorian Department of Education and Training [Risk Management](http://www.education.vic.gov.au/school/principals/spag/governance/pages/risk.aspx) policy and related references, which provide tools and links to resources that assist in identifying and mitigating against risk in schools.

In this unit of work, particular consideration should be given to ensuring adequate supervision when students are using scissors, skewers or a hairdryer:

* It is recommended that the hairdryer is used by an adult, but if students use the hairdryer, instruct them to not point the hairdryer at others.
* When students are using the hairdryer, long hair should be tied back to prevent it being drawn into the fan of the appliance.
* The hairdryer must not be used near water.
* Students should be instructed to pass sharp objects handle first, not blade or point first.

Key concepts and vocabulary

**Characteristic:** An attribute of a material that is usually detected using human senses, such as its texture or colour; for example, the characteristics of a piece of corrugated cardboard include a wrinkled texture and a brown colour

**Material:** A substance from which something is made

**Property:** A quality or behaviour of a material that can be tested and can be used to help people select suitable materials for particular uses; for example, people consider properties such as the flexibility and strength of a material when choosing material to build a house

Learning sequence

Session 1

*(Approx. 1 hour)*

**Learning intention:**

We will understand the story of the Three Little Pigs and we will be able to identify the properties and characteristics of materials used to make shelters.

**Success criteria:**

I can recount the story of the Three Little Pigs.

I can identify examples of shelters and the characteristics and properties of what they are made of.

* Read the story of the Three Little Pigs to the students. This could be done in a range of ways, including via audiobook or video (see [FUSE resource package F78SBM](http://fuse.education.vic.gov.au/?F78SBM)).
* Introduce the words ‘material’, ‘characteristic’ and ‘property’ to students. Discuss the meaning of each word and record these meanings with examples in the class journal.
* Discuss with students what they noticed about the shelters of each of the pigs, in terms of what materials they were made of and what happened to each house when the wolf arrived. Document the students’ ideas on a whiteboard or in a class journal (a hard-copy class journal or digital class blog, for example, using [Global2](http://global2.vic.edu.au/) or [Padlet](https://padlet.com/)).
* Provide students with images of a range of shelters including houses (see [FUSE resource package F78SBM](http://fuse.education.vic.gov.au/?F78SBM)). Ask students to examine the images and to generate a list of as many different materials as they can. Ask students to identify different types of characteristics and properties of the materials. Document student answers in the class journal.
* Ask students why they think different materials are used for different parts of a house or shelter. Document students’ answers in the class journal.
* Present to students the challenge of building their own unique and innovative shelter to protect the Three Little Pigs from the Big Bad Wolf and encourage them to begin thinking of ways to do this.

Session 2

*(Approx. 1.5 hours)*

**Learning intention:** We will understand that materials have different characteristics and properties that make them useful for different functions.

**Success criteria:**

I can observe the characteristics of a range of materials, and I can test the properties of a range of materials

I can decide which materials could be used to make a shelter.

* Revisit the terms ‘material’, ‘characteristic’ and ‘property’ to ensure students understand these key words before beginning the investigation.
* Explain to students that today we will be testing a range of materials that could be used to make a shelter. Explain that we want to make sure none of their shelters are destroyed when the Big Bad Wolf arrives.
* Provide students with copies of the ‘Materials testing and observation’ template ([Appendix 1](#Appendix1)). Explicitly teach the student how to use this template, clarifying any words or sections that are unclear to students.
* Introduce the word ‘observe’ to students and discuss that when we test anything or do an experiment we need to record (using video or audio), write down or draw what is happening. Explain that we record, write down or draw what we observe so that it is easier to remember later when we want to talk about what happened and discuss why it might have happened. Encourage students to identify times when they are observing in their activity today and document the new word in the class journal.
* Break up students into small groups of approximately three for the testing activity.
* Help students create a question for their investigation. Use key question words as sentence starters, such as ‘*Which* material will …?’ or ‘*How* will material X …?*’* A single question for the whole class is suitable, or groups could be supported to create their own – this provides an opportunity to differentiate the instruction.
* Provide students with a range of materials to examine (see [Equipment and resources](#Equipmentandresources)). Direct students to choose a material, identify its characteristics and then test out its properties, using the ‘Materials testing and observation’ template ([Appendix 1](#Appendix1)) as a guide. Explain that as they finish with one material, they should return it and choose another. Encourage the use of specific words when discussing the characteristics and properties of materials, such as ‘soft’, ‘hard’, ‘smooth’, ‘rough’, ‘thin’, ‘thick’, ‘flexible’, ‘stiff’and ‘strong’.Share results as a class and record student contributions and conclusions in the class journal.
* Provide opportunities for students to investigate which materials would be suitable for making parts of their shelter and for students to talk about why these materials are or are not suitable. Encourage students to reuse specific words relating to the characteristics and properties of materials when thinking about materials they could use in their design.
* Direct student groups to come up with design ideas for their shelter and communicate them via a drawing or any other appropriate modelling technique. They need to choose at least two materials they would like to use for their shelter, and record these on the ‘Materials testing and observation’ template. Time permitting, students could label some features on their drawing, or if they’ve made a model, they could write a list of features or describe what their final shelter would look like.

Session 3

*(Approx. 2 hours)*

**Learning intention:**

We will be able to use our knowledge of the characteristics and properties of materials to make a shelter for the Three Little Pigs.

**Success criteria:**

I can choose and use materials to build a shelter.

I can use the characteristics and properties of materials to explain why I choose to use them in my shelter.

* Remind students that their challenge is to build a shelter to withstand the Big Bad Wolf and ask them to revisit the criteria for success in relation to the challenge. Show students the hairdryer ‘wolf’ and demonstrate the strength of the ‘wind’ it produces.
* Show students the materials, equipment and other resources that are available to use for their houses or shelters.
* Referencing the student designs that were drawn or modelled in the previous session, discuss ways the materials could be fixed together or joined, and re-model as needed.
* Demonstrate how scissors and other equipment are used safely. Monitor levels of student capability and intervene and adjust protocols as needed.
* Allow time for groups to collect resources and begin production of their shelters. Remind students to review and check their testing results from the previous session before collecting materials, as this may assist with their decision-making.
* Monitor group progress as students complete their production work, and support with suggestions for production, materials, etc. Also use this time to monitor student progress towards the achievement standard related to the Creating Designed Solutions content description [VCDSCD020](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSCD020), using the supplied rubric ([Appendix 4](#Appendix4)).
* When all groups have completed their shelters, display them at the front of the room.
* Ask students to discuss the different materials used in the shelters as well as how they have been put together.
* Allow students time to refine or adjust their designs based on what they see in other groups’ designs. Remind the students about the criteria for success in relation to the challenge. Record student refinements and observations in the class journal.
* Explain to students that they will be testing their shelters against the Big Bad Wolf in the next session.

Session 4

*(Approx. 1 hour)*

**Learning intention:**

We will be able to test our shelters and reflect on why they worked or why they did not work.

**Success criteria:**

I can make and test predictions about which shelters will be able to withstand the Big Bad Wolf.

I can make observations about which shelters withstand the Big Bad Wolf and discuss why shelters did or did not stay standing.

* Explain to students that in this session each of their shelters will be visited by the Big Bad Wolf and that they will be testing if their shelter is strong enough to stay standing. Explain that each shelter will be tested with the hairdryer, on one setting for a set amount of time. Provide time for students to draw or create representations of the Three Little Pigs or the Big Bad Wolf if they would like to and if time permits.
* Introduce students to the ‘Shelter testing’ template ([Appendix 2](#Appendix2)). Note, a copy of the template could be given to each individual or group to complete or one could also be used by a whole class, depending on student needs.
* Take time to ensure all students understand the meaning of each word used in the template, and provide examples of how to use each section of the template. For example, explain that a prediction begins with ‘I think’ or ‘I predict’ and that observations can describe what we see and hear happen.
* Provide time for all students to make predictions about whether their house will withstand the Big Bad Wolf or not. Highlight to students that all predictions are valued, even if they are incorrect in the end, because we can learn from thinking about why a prediction was correct or incorrect. Use the ‘Shelter testing’ template ([Appendix 2](#Appendix2)) to assess student progress towards the achievement standard related to Science Inquiry Skills content descriptions [VCSIS050](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSIS050) and [VCSIS051](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSIS051), using the supplied rubric ([Appendix 4](#Appendix4)).
* Use the hairdryer to test each house. Direct students to make and document observations of what happens to each shelter.
* Once all shelters have been tested, compare students’ predictions with the documented observations and discuss. Use the ‘Explain’ section of the template to note reasons for student predictions being different to observations of what actually happened.
* Discuss with students why some shelters stayed standing and others did not. Use the questions formulated in Session 2 as an anchor for this discussion. Encourage students to think about the characteristics and properties of the materials used and how they were put together as explanations for a shelter standing or falling.
* Support students to make conclusions about why different materials are more suited to certain jobs or functions, using the evidence from the materials investigation and the testing of their shelters. Students should document these conclusions individually. These conclusions can be used to assess student understanding of Chemical sciences and Materials and technologies specialisations content descriptions using the supplied rubric ([Appendix 4](#Appendix4)).
* Finish the session by supporting students to complete the ‘Student reflection and self-evaluation’ template ([Appendix 3](#Appendix3)).

**Assessment strategies**

* Developmental rubric for all strands explicitly taught ([Appendix 4](#Appendix4))
* Student reflection and self-evaluation ([Appendix 3](#Appendix3))

Additional resources

**Resource and owner:** [The Three Little Pigs and the Big Bad Challenge!](http://schroederpage.blogspot.com/2014/05/the-three-little-pigs-and-big-bad.html), The Schroeder Page

**Description:** This is a blog page of a similar project completed by students. (Please note, this project does not align with the Victorian Curriculum.)

**Resource and owner:** [Lesson Plan: The Fourth Little Pig Engineering Design Challenge (PDF, 32MB)](http://www.chem.ucsb.edu/scsp/sites/secure.lsit.ucsb.edu.chem.d7_scsp/files/sitefiles/lessons/Lesson%20Plan%20Fourth%20Little%20Pig%202017.pdf), Mandi de Witte

**Description:** This is a similar, although shorter, design project. It also incorporates elements of financial mathematics. (Please note, this project does not align with the Victorian Curriculum.)

Appendix 1: Materials testing and observations

Group members: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What are we trying to find out? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Material 1** | **Does it bend?** | **Does it stretch?** | **Is it soft or hard?** | **Is it strong?** | **Is it thick or thin?** |
| My material is… |  |  |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Material 2** | **Does it bend?** | **Does it stretch?** | **Is it soft or hard?** | **Is it strong?** | **Is it thick or thin?** |
| My material is… |  |  |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Material 3** | **Does it bend?** | **Does it stretch?** | **Is it soft or hard?** | **Is it strong?** | **Is it thick or thin?** |
| My material is… |  |  |  |  |  |

**What materials do you think could make a shelter?** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Appendix 2: Shelter testing

Group members: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |
| --- | --- | --- |
| **Predict**: What do you **think** will happen to the shelter? | **Observe:** What **did happen** to the shelter? | **Explain: Why** did this happen to the shelter? Explain why your prediction was correct or incorrect. |
|  |  |  |

(You can write or draw your answers.)

**Summing up our testing**

Did your shelter stay standing when the Big Bad Wolf ‘huffed and puffed’? Yes / No

Did the materials you used help your shelter stay standing? Yes / No

Why do you think they helped or not?

Appendix 3: Student reflection and self-evaluation

|  |  |  |  |
| --- | --- | --- | --- |
| **How well can you do these now?** | **☺****(Getting there)** | **☺☺****(Got it)** | **☺☺☺****(Nailed it!)** |
| I can identify what a shelter is made of. |  |  |  |
| I can identify the characteristics and properties of different materials. |  |  |  |
| I can use tools, equipment and materials safely. |  |  |  |
| I can work in a team to make a small shelter. |  |  |  |
| I can make predictions about what will happen to a shelter. |  |  |  |
| I can use my senses to make observations about what happens. |  |  |  |
| I can talk about why a material worked or did not work in a shelter. |  |  |  |
| One thing I could do better next time is |

Appendix 4: Teacher assessment rubric

|  | **Strand** | **Sub-strand** | **Achievement standard extract** |  | **Progressing towards Level 2** | **Level 2** | **Progressing towards Level 3–4**  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Design and Technologies** | **Creating Designed Solutions** | **Producing** | Demonstrate safe use of tools and equipment when producing designed solutions | Insufficient evidence | Student can safely use tools with support from an adult | Student can independently use provided tools safely | Student can select and use tools safely |
| **Technologies Contexts** | **Materials and technologies specialisations** | Create designed solutions for each of the prescribed technologies contexts | Insufficient evidence  | Student can identify observable features of a material when creating a designed solution | Student can explore the properties and characteristics of materials used and describe why they were chosen when creating a designed solution | Student can explain why materials are suitable for a designed solution based on their properties and characteristics and identify impacts of their use |
| **Science** | **Science Understanding** | **Chemical science** | Describe the properties, behaviour, uses and the effects of interacting with familiar materials and objects. | Insufficient evidence | Student can identify if a material has a given property | Student can make observations about what things are made of and describe what they look and feel like | Student can discuss how different properties of materials can influence their use |
| Insufficient evidence | Student can follow provided techniques for combining materials | Student can choose a range of techniques to combine materials | Student can discuss why specific techniques are used to combine materials |
| **Science Inquiry Skills** | **Questioning and predicting** | Pose and respond to questions about familiar objects and events and predict outcomes of investigations. | Insufficient evidence | Student can respond to questions | Student can pose and respond to questions | Student can pose and respond to a question that can be investigated |
| Insufficient evidence | Student can respond to predictions | With guidance, student can make predictions about an experiment | With guidance, student can make predictions by using their prior knowledge about an experiment |
| **Planning and conducting** | They use their senses to explore the world around them. | Insufficient evidence | Student can follow teacher prompts to use specific senses to make observations | Student can use their senses to make observations | Student can use their senses to make observations and then retell what happened in an experiment |