Science and Technology

Exploring the Material World in Science and Technology K – 6
Overview

Welcome


Material World is a new area of content in the K-10 syllabus.

**This resource aims to support K-6 teachers to:**

- gain a deeper understanding of syllabus outcomes and content relating to Material World, and why this learning is important to the study of both science and technology
- consider how the skills of Working Scientifically and Working Technologically may be integrated with Material World
- implement the Material World substrand of the new syllabus
Overview

This teaching resource explores the new Material World substrand and its role in the K-6 science and technology component of the syllabus.

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<td>In order to gain a deeper understanding of the progression of learning from Early Stage 1 to Stage 4, this section outlines the key scientific concepts that underpin the content described in the Material World substrand.</td>
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Rationale

Material World has an important role in contributing to learning in both science and technology K-6.

Material World substrand provides foundations for the Chemical World strand in the science Years 7-10 component of the syllabus, and for the study of materials in the Technology (Mandatory) syllabus in Years 7-8.

In the Chemical World strand of science Years 7-10, chemistry may be seen as the science that connects the physical to the living world. The composition of materials, as well as the properties and behaviour of materials, form the basis of the study of chemistry. The changes in these properties are critical to the survival of living things.

In the Technology (Mandatory) Year 7-8 syllabus, knowledge and understanding of materials, and skills in the responsible selection and safe use of materials, tools and techniques are fundamental to the design and production of quality solutions. This learning includes the areas of study of Built Environments, Products and Information and Communications. This is the material world on which we all depend.
Materials in the Natural and Made Environments

An introduction to materials in the Natural and Made Environments

The content for Kindergarten to Year 6 in the new Science K-10 (incorporating Science and Technology K-6) Syllabus is organised in strands and substrands. The Knowledge and Understanding strands are Natural Environment and Made Environment.

Material World is a substrand in both of these strands. It is the only substrand included in both Knowledge and Understanding strands because Material World content is about both natural and made materials. The outcomes and content from the Material World cannot easily be identified as belonging to either Natural Environment or Made Environment - they relate to both. Students develop knowledge and understanding of the Natural and Made Environments through the Material World.

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Organisation of Material World in the Knowledge and Understanding strands for Science and Technology K-6

In the Material World substrand, the syllabus describes content relating to the properties of materials and the way they behave, the changes they undergo and how these properties influence the way materials are used.

Some Material World outcomes relate to knowing and understanding the nature of materials and some relate more to what students need to know to use materials effectively. Knowledge and understanding about the nature of materials generally comes from using the process of Working Scientifically. Knowledge and understanding about how to use materials generally comes through the process of Working Technologically.
The outcomes from Material World provide a foundation for the continued study of science and technology in Years 7 and 8. The progression of learning for science and technology from Early Stage 1 – Stage 4 includes outcomes and content in two syllabuses – the new Science K-10 (incorporating Science and Technology K-6) Syllabus, and the Technology (Mandatory) Years 7-8 Syllabus. It is important for K-6 teachers to be aware of the outcomes and content across the progression. The achievement of outcomes expected at the end of each stage from ES1 – S3 prepares students for the skills, knowledge and understanding they will need to engage with content in the next stage.

View the progression of learning in the *Progression through outcomes* PDF, which outlines the progression of outcomes and content relating to Material World from Early Stage 1 – Stage 4.
Key concepts

As discussed in the previous section, the syllabus provides continuums of learning in science K-10 and technology K-8 based on outcomes and content. Knowledge of the progression of learning in science and technology supports the development of teaching programs including a scope and sequence and unit and lesson plans.

In developing teaching programs, it is important to recognise that a student’s progression of learning is closely linked to the development of their understanding of the underlying scientific concepts. The study of materials by scientists over the last few hundred years has resulted in the development of a number of important key concepts.

The key concepts of science that are the basis of the Material World content in the K-6 science and technology component of the syllabus are identified below. These concepts support the notion that when we understand the composition of materials, their properties and behaviours, we can use them effectively.

- All materials (including gases) are made up of particles and that is why they have mass and take up space.

- Materials come in three states of matter and they behave differently when heat is added and/or removed. Some of these changes are reversible and are referred to as physical change.

- New materials are formed when certain substances are mixed together and/or heated. These changes are irreversible and are referred to as a chemical change.

- Some materials can change shape without changing their state of matter. The physical properties of natural and processed materials influence their use.

*NB: This summary is of key concepts that are addressed by the end of Stage 3.*

Exploration of key concepts

Let's have a closer look at each of the key concepts. The following materials relating to each of the key concept includes three parts:

- an animation, showing a discussion between two teachers about the underlying scientific concept addressed through the syllabus outcomes

- a table, illustrating the development of each key concept through the relevant syllabus content

- sample teaching activities, providing examples of opportunities for students to achieve syllabus outcomes through development of knowledge and understanding of the key concept.
Key concept 1:

All materials (including gases) are made up of particles and that is why they have mass and take up space.

View the following animation – MW particles outlining a discussion about this key concept.

Examine the table of syllabus content showing the development of the key concept of particles across stages.

View the sample teaching activities_particles PDF to see examples of how the key concept of particles could be approached in the classroom.
Key concept 2:

Materials come in three states of matter and they behave differently when heat is added and/or removed. Some of these changes are reversible and are referred to as physical change.

View the following animation – MW reversible changes outlining a discussion about this key concept.

Examine the table of syllabus content showing the development of the key concept of reversible changes across stages.

View the sample teaching activities reversible changes PDF to see examples of how the key concept of reversible changes could be approached in the classroom.
Key concept 3:

New materials are formed when certain substances are mixed together and/or heated. These changes are irreversible and are referred to as a chemical change.

View the following animation – *MW irreversible changes* outlining a discussion about this key concept.

Examine the table of syllabus content showing the development of the key concept of irreversible changes across stages.

View the [sample teaching activities irreversible changes](#) PDF to see examples of how the key concept of irreversible changes could be approached in the classroom.
Key concepts 4 and 5:

Some materials can change shape without changing their state of matter. The physical properties of natural and processed materials influence their use.

View the following animation outlining a discussion about the key concept of materials changing shape without changing their state of matter.

Now view the following animation outlining a discussion about the key concept of physical properties of natural and processed materials influencing their use.
Examine the table of syllabus content showing the development of the key concept of materials changing shape without changing their state of matter across stages.

Examine the sample teaching activities of changing shape and design influence PDF to see examples of how these two key concepts could be approached in the classroom.

In summary

An understanding of key scientific concepts is essential for curriculum planning and programming in Science and Technology K-6.

Download the overview of Material World key concepts PDF to support your understanding of the key concepts.

You can also view a compilation of sample teaching activities all concepts for a better understanding of the Material World key concepts.

Students bring prior knowledge to science and technology from a range of experiences including prior learning experiences and cultural or religious beliefs. Sometimes the prior knowledge that a student brings to the classroom may contribute to a misconception in science – a view that is alternative to that which is recognised by the science community.

The following section, Assessing key concepts, will assist you in identifying misconceptions that students may bring to the classroom and suggests how these misconceptions might be addressed through teaching programs.
Assessing key concepts

Students gain knowledge and understanding through classroom learning experiences as well as experiences in their everyday lives. It is through these experiences that they often bring misconceptions to the classroom.

For example, the fact that Earth travels around the Sun is not immediately obvious from our daily experiences. Similarly, the notion that the air is simply empty space might also be a misconception held by many students.

Sometimes the use of everyday language can lead to misconceptions in science. For example – “the sun is going down” or “the room is empty”.

The following PDF provides sample questions for students, related to the Material World. Also included is a distractor analysis for each question suggesting possible student misconceptions.

It is important to note that these tools are diagnostic in purpose and intended to assist teachers to identify students who may have misconceptions, and the reasons for the misconception. They are not intended to be used as a test to assess student knowledge and understanding in relation to outcomes.

View the assessment item analysis PDF to consider how the sample questions could be used to inform your teaching, and how they might assist you in identifying and addressing student misconceptions.
Working Scientifically and Technologically through the Material World

Students develop an understanding of materials and the use of materials through applying the processes of Working Scientifically and Working Technologically.

The following sample teaching activities outline experiences for students to achieve Material World outcomes, while integrating the skills of Working Scientifically and Working Technologically.

The teaching activities address selected outcomes and content from both the Working Scientifically and Working Technologically strands.

Open the Material World sample teaching activities and consider making modifications relating to the needs, interests and abilities of your students and classroom context.
Consider how the teaching activities could be used to develop a unit of work.

You may also need to reflect on your approach to teaching the previous Science and Technology K-6 Syllabus, and consider how the interrelated nature of strands in the new syllabus may change your teaching practice.
Where to next?

Further learning

Implementing the new curriculum

There are a number of registered courses designed to assist with the implementation of the new curriculum.

Follow the link to the *NSW syllabuses for the Australian Curriculum: Implementation support* website for comprehensive information, links to courses and resources.
The following are specific to Science and Technology:

Implementing the new curriculum – Your school and the syllabus – Science and Technology K-6

Implementing the new curriculum – A process for programming a unit of learning: Science and Technology K-6

The Programming for quality teaching and assessing course provides a guided approach to curriculum planning and development of teaching programs and assessments.
The Board of Studies NSW Support Material notes that continuity of learning in all aspects of the syllabus is provided when teaching programs:

- are based on contexts that:
  - are relevant to students’ learning needs, interests, experiences and cultural backgrounds
  - relate to the nature, development, use and influence of science and technology
- draw on content from the Natural Environment and the Made Environment strands in each year
- incorporate the strands and substrands within each stage
- integrate the skills and processes of Working Scientifically and Working Technologically with content from the Knowledge and Understanding strands/substrands
- include a range of hands-on scientific investigations and design projects in each year from K–6 in which students apply the processes of Working Scientifically and Working Technologically
- address the objectives and outcomes for the values and attitudes through the relevant skills, knowledge and understanding content for each stage.

Both the structure of the syllabus and the Board’s advice on programming suggest that the processes of working scientifically and working technologically are the central elements in the planning of an effective program.

A process-driven approach to teaching and learning has significant implications for the planning of learning activities. Consider issues which may emerge when planning a teaching sequence based on a design process.
You have now engaged with the *Exploring with Material World in Science and Technology K – 6*.

Other suggested DEC resources are:

- **Working Scientifically in K-6**
  
  This resource is designed to assist teachers in their understanding of the skills strand of Working Scientifically.

- **Working Technologically in K-6**
  
  This resource is designed to assist teachers in their understanding of the skills strand Working Technologically.