The aim of this unit is to enable the learner to support the development of science and technology learning for children and/or young people.

**Learning outcomes**

1. Understand science and technology learning when working with children and/or young people.
2. Understand learning needs of individual children and/or young people when supporting the development of science and technology.
3. Be able to plan and deliver science and technology activities for children and/or young people.
4. Be able to reflect on own practice.

**Curriculum frameworks to support science and technology**

You need to be able to summarise current education thinking which supports children and/or young people to learn about science concepts and technology. For example, in England the curriculum frameworks for education are the Early Years Foundation Stage (0–5 years) and the National Curriculum Key Stages 1 to 4 (5–16 years).

**The 2012 Early Years Foundation Stage**

On 6 July 2012, a revised draft EYFS framework was issued for consultation, taking forward Dame Tickell’s proposals for reform: reducing paperwork and bureaucracy for professionals; focusing strongly on the three prime areas of learning most essential for children’s healthy development and future learning (with four specific areas in which the prime areas are applied); simplifying assessment at age five, including reducing the early learning goals (ELGs) from 69 to 17; and providing for earlier intervention for those children who need extra help, through the introduction of a progress check when children are age two (DfE 2011a, p. 1).

This revised EYFS was published on 27 March 2012 and was implemented from September 2012. There are seven areas of learning and development that must shape educational programmes in early years.
settings. Three areas are particularly important for igniting young children’s curiosity and enthusiasm for learning, and for building their capacity to learn and to thrive. These three areas, known as the *prime* areas, are:

- personal, social and emotional development
- physical development
- communication and language.

Early years providers must also support young children in four *specific* areas of learning and development through which the three prime areas are strengthened and applied. The specific areas are:

- literacy
- mathematics
- understanding the world
- expressive arts and design.

‘Understanding the world’ in the revised EYFS

‘Understanding the world’ involves guiding children to make sense of their physical world and their community through opportunities to explore, observe and find out about people, places, technology and the environment (DfE 2012, p. 5).

By the end of the EYFS, children should have achieved the following early learning goals in understanding the world:

- **People and communities**: children talk about past and present events in their own lives and in the lives of family members. They know that other children do not always enjoy the same things and are sensitive to this. They know about similarities and differences between themselves and others, and among families, communities and traditions.
- **The world**: children know about similarities and differences in relation to places, objects, materials and living things. They talk about the features of their own immediate environment and how environments might vary from one another. They make observations of animals and plants and explain why some things occur, and also talk about changes.
- **Technology**: children recognise that a range of technology is used in places such as homes and schools. They select and use technology for particular purposes.

(DfE 2012, p. 9)

*Development Matters in the Early Years Foundation Stage (EYFS)* provides non-statutory guidance to support early years practitioners in implementing the statutory requirements of the EYFS. (See ‘Useful resources’ at the end of the chapter; for detailed information about the EYFS, see Chapter 12.)

Science and technology learning is also covered by some aspects of the specific area ‘Expressive arts and design’, which involves enabling children to explore and play with a wide range of media and materials through a variety of activities such as art, design and technology. (See Unit 11 Support children and/or young people’s development of art, drama and music.)

**Research Activity**

Find out more about science and technology in the EYFS. For example, have a look at the section ‘Understanding the world’ on the Foundation Years website: www.foundationyears.org.uk.

**The National Curriculum in England**

The National Curriculum sets out the statutory requirements for the knowledge and skills that every child is expected to learn in schools. The National Curriculum applies to children of compulsory school age in schools in England. The National Curriculum sets out what pupils should study, what they should be taught and the standards that they should achieve. It is divided into four key stages:

- **Key Stage 1**: Year groups 1 and 2 (5–7 year olds)
- **Key Stage 2**: Year groups 3, 4, 5 and 6 (7–11 year olds)
- **Key Stage 3**: Year groups 7, 8 and 9 (11–14 year olds)
- **Key Stage 4**: Year groups 10 and 11 (14–16 year olds)

In Key Stages 1 and 2 of the National Curriculum, the compulsory subjects consist of: English, mathematics, science, information and communication technology, design and technology, history, geography, art and design, music, and physical education.
In Key Stage 3 of the National Curriculum, the compulsory subjects are: English, mathematics, science, information and communication technology, design and technology, history, geography, art and design, music, physical education, citizenship, and modern foreign languages.

In Key Stage 4, the compulsory subjects are: English, mathematics, science, information and communication technology, physical education, and citizenship. Secondary schools must make entitlement curriculum areas (e.g. the arts, design and technology, the humanities and modern foreign languages) available to all students who wish to study them. In addition, there is a statutory requirement for work-related learning and a non-statutory framework setting out the minimum experience that schools should provide for work-related learning. In January 2011, the Secretary of State for Education announced a review of the National Curriculum in England. While the review is being conducted, the existing National Curriculum requirements for both primary and secondary schools will remain in force.

The Department for Education has published draft primary national curriculum programmes of study for English, mathematics and science; the final programmes will be introduced into primary schools in September 2014. For example, in science, there will be new content in the curriculum about evolution, the solar system and speed, as well as scientific experiments and demonstrations. There will be no other changes to the structure of the primary curriculum. The government will maintain the requirement for the teaching of art and design, design and technology, geography, history, ICT, music, and physical education throughout primary school (Gaunt 2012).

(You can find more detailed information on this in Chapter 12.)

Science in the primary years

In the primary years, supporting children’s learning in science should ensure that ‘scientific enquiry’ is taught through contexts taken from the sections on ‘life processes and living things’, ‘materials and their properties’ and ‘physical processes’.

In Key Stage 1, the curriculum should provide opportunities for pupils to:

- observe, explore and ask questions about living things, materials and phenomena
- begin to work together to collect evidence to help them answer questions and to link this to simple scientific ideas
- evaluate evidence and consider whether tests or comparisons are fair
- use reference materials to find out more about scientific ideas
- share their ideas and communicate them using scientific language, drawings, charts and tables.

(DfE 2011b)

In Key Stage 2, the curriculum should provide opportunities for pupils to:

- learn about a wider range of living things, materials and phenomena
- begin to make links between ideas and to explain things using simple models and theories
- apply their knowledge and understanding of scientific ideas to familiar phenomena, everyday things and their personal health
- begin to think about the positive and negative effects of scientific and technological developments on the environment and in other contexts
- carry out more systematic investigations, working on their own and with others
- use a range of reference sources in their work
- talk about their work and its significance, and communicate ideas using a wide range of scientific language, conventional diagrams, charts and graphs.

(DfE 2011b)

Research Activity

Find out more about science in Key Stage 1 and Key Stage 2. For example, have a look at the section about primary science on the Department for Education website: www.education.gov.uk/schools/teachingandlearning/curriculum/primary/b00199179/science.
Science in the secondary years

In the secondary years, the study of science should ignite pupils’ curiosity about the world around them and offer opportunities to find explanations. Supporting children’s learning in science should engage pupils at many levels, providing them with opportunities to link direct practical experience with scientific ideas. Experimentation and modelling are used to develop and evaluate explanations, encouraging critical and creative thought. Pupils learn how knowledge and understanding in science are rooted in evidence. They discover how scientific ideas contribute to technological change – affecting industry, business and medicine, and improving quality of life. They trace the development of science worldwide and recognise its cultural significance. They learn to question and discuss issues that may affect their own lives, the directions of societies and the future of the world (DfE 2011c).

In Key Stage 3, the curriculum should provide opportunities for pupils to:

- research, experiment, discuss and develop arguments
- pursue an independent enquiry into an aspect of science of personal interest
- use real-life examples as a basis for finding out about science
- study science in local, national and global contexts, and appreciate the connections between these
- experience science outside the school environment, including in the workplace, where possible
- use creativity and innovation in science and appreciate their importance in enterprise
- recognise the importance of sustainability in scientific and technological developments
- explore contemporary and historical scientific developments
- prepare to specialise in a range of science subjects at Key Stage 4 and consider career opportunities both within science and in other areas that are provided by science qualifications
- consider how knowledge and understanding of science informs personal and collective decisions, including decisions relating to substance abuse and sexual health
- make links between science and other subjects and areas of the curriculum.

(DfE 2011c)

In Key Stage 4, the curriculum should provide opportunities for pupils to learn that:

- organisms are interdependent and adapted to their environments
- variation within species can lead to evolutionary changes and similarities and differences between species can be measured and classified
- the ways in which organisms function are related to the genes in their cells
- chemical and electrical signals enable body systems to respond to internal and external changes, in order to keep the body in an optimal state
- human health is affected by a range of environmental and inherited factors, including by the use and misuse of drugs and by medical treatments
- chemical change takes place through the rearrangement of atoms in substances
- there are patterns in the chemical reactions between substances
- new materials are made from natural resources by chemical reactions
- the properties of a material determine its uses
- energy transfers can be measured and their efficiency calculated, which is important in considering the economic costs and environmental effects of energy use
- electrical power is readily transferred and controlled, and can be used in a range of different situations
- radiations, including ionising radiations, can transfer energy
- radiations in the form of waves can be used for communication
- the effects of human activity on the environment can be assessed using living and non-living indicators
- the surface and the atmosphere of the Earth have changed since the Earth’s origin and are changing at present
- the solar system is part of the universe, which has changed since its origin and continues to show long-term changes.

(DfE 2011c)
Science choices for 16–18-year-olds in England include continuing in full-time education either at school/college through studying for academic qualifications such as ‘AS’ or ‘A’ levels (e.g. biology, chemistry, environmental science or physics) or vocational qualifications (e.g. BTEC First or National Diplomas in Applied Science). Selected colleges also offer the Diploma qualification for 14–19-year-olds (see below).

**Research Activity**

Find out more about science in Key Stage 3, Key Stage 4 and beyond. For example, have a look at the following sections on the Department for Education website:

- Science in secondary schools: www.education.gov.uk/schools/teachingandlearning/curriculum/secondary/b00198831/science
- GCSEs: www.direct.gov.uk/en/EducationAndLearning/QualificationsExplained/DG_10039024
- The 14 to 19 Diploma: www.education.gov.uk/schools/teachingandlearning/qualifications/diploma.

**ICT in the primary years**

In the primary years, supporting children’s learning in information and communication technology (ICT) involves helping them to learn how to control a computer, including using a computer for word processing, developing pictures using ‘paint’ software, making tables or graphs, and accessing information via the internet.

In Key Stage 1, the curriculum should provide opportunities for pupils to:

- explore ICT and learn to use it confidently and with purpose to achieve specific outcomes
- start to use ICT to develop their ideas and record their creative work
- become familiar with hardware and software (e.g. explore a variety of ICT tools, such as floor turtle, word processing software and adventure games)
- work with a range of information to investigate the different ways it can be presented (e.g. information about the sun presented as a poem, picture or sound pattern)
- talk about the uses of ICT inside and outside school.

(DfE 2011d)
In Key Stage 2, the curriculum should provide opportunities for pupils to:

- use a wider range of ICT tools and information sources to support their work in other subjects
- develop their research skills and decide what information is appropriate for their work
- begin to question the plausibility and quality of information
- learn how to amend their work and present it in a way that suits its audience
- work with a range of information to consider its characteristics and purposes (for example, collecting factual data from the internet and a class survey to compare the findings)
- work with others to explore a variety of information sources and ICT tools (for example, searching the internet for information about a different part of the world, designing textile patterns using graphics software and using ICT tools to capture and change sounds)
- investigate and compare the uses of ICT inside and outside school.

(DfE 2011d)

Research Activity

Find out more about ICT in Key Stage 1 and Key Stage 2. For example, have a look at the section about primary ICT on the Department for Education website: www.education.gov.uk/schools/teachingandlearning/curriculum/primary/b00199028/ict.

ICT in the secondary years

Due to the increasing use of technology in all aspects of society, developing confidence in the use of ICT is an essential life skill. ICT capability encompasses not only the mastery of technical skills and techniques, but also the understanding to apply these skills purposefully, safely and responsibly in learning, everyday life and employment. ICT capability is fundamental to participation and engagement in modern society (DfE 2011e).

In Key Stage 3, the curriculum should provide opportunities for pupils to:

- make choices about when and where it is appropriate to exploit technology to support them in their learning and everyday life
- work creatively and collaboratively
- be independent, discerning and reflective when choosing when to use technology
- apply ICT to real-world situations when solving problems and carrying out a range of tasks and enquiries
- share their views and experiences of ICT, considering the range of its uses and its significance to individuals, communities and society
- use ICT in other subjects and areas of learning with contexts that are relevant and interesting to them.

(DfE 2011e)

In Key Stage 4, pupils study compulsory subjects such as English, mathematics and science, which usually involve taking GCSEs. Pupils also have to study other subjects such as ICT, which may not necessarily involve taking exams. During Key Stage 4, the curriculum should provide opportunities for students to:

- make choices about when and where it is appropriate to exploit technology to support them in other areas of learning and everyday life
- work creatively and collaboratively, taking different roles in teams
- be independent, discerning and reflective when choosing when to use technology
- use ICT to manage themselves, their work and their learning
- apply ICT to real-world situations when solving problems and carrying out a range of tasks and enquiries
- use initiative to find out about and exploit the potential of more advanced or new ICT tools and information sources
- evaluate their experiences of using ICT, considering the range of its uses and its significance to individuals, communities and society

(DfE 2011e)
Chapter 14 Supporting science and technology development in children and/or young people (Unit CP 18)

- use ICT in other subjects and areas of learning with contexts that are relevant and interesting to them.

(DfE 2011e)

ICT choices for 16–18-year-olds in England include continuing in full-time education either at school or college through studying for academic qualifications such as ‘AS’ or ‘A’ levels (e.g. information and communication technology) or vocational qualifications (e.g. apprenticeships in information technology, BTEC First or National Diplomas in ICT for Practitioners, C&G Diplomas in ICT Systems Support). Selected colleges also offer the Diploma qualification for 14–19-year-olds (see below).

Research Activity

Find out more about ICT in Key Stage 3, Key Stage 4 and beyond. For example, have a look at the following sections of the Department for Education website:

- ICT in secondary schools: www.education.gov.uk/schools/teachingandlearning/curriculum/secondary/b00199065/ict
- GCSEs: www.education.gov.uk/schools/teachingandlearning/qualifications/gcses
- The 14 to 19 Diploma: www.education.gov.uk/a0064416/what-is-the-diploma.

Design and technology in the primary years

Teaching should ensure that ‘knowledge and understanding’ are applied when ‘developing ideas’, ‘planning’, ‘making products’ and ‘evaluating’ them.

During Key Stage 1, pupils learn how to think imaginatively and talk about what they like and dislike when designing and making. They build on their early childhood experiences of investigating objects around them. They explore how familiar things work and talk about, draw and model their ideas. They learn how to design and make safely and could start to use ICT as part of their designing and making (DfE 2011f).

During the Key Stage, pupils should be taught the knowledge, skills and understanding through:

- investigating and evaluating a range of familiar products (for example, talking about how they work, and whether they do what they are supposed to do)
- focused practical tasks that develop a range of techniques, skills, processes and knowledge
- design-and-make assignments using a range of materials, including food, items that can be put together to make products, and textiles.

(DfE 2011f)

During Key Stage 2, pupils work on their own and as part of a team on a range of designing and making activities. They think about what products are used for and the needs of the people who use them. They plan what has to be done and identify what works well and what could be improved in their own and other people’s designs. They draw on knowledge and understanding from other areas of the curriculum and use computers in a range of ways (DfE 2011f).

During the Key Stage, pupils should be taught the knowledge, skills and understanding through:

- investigating and evaluating a range of familiar products, thinking about how they work, how they are used and the views of the people who use them
- focused practical tasks that develop a range of techniques, skills, processes and knowledge
- design-and-make assignments using a range of materials, including electrical and mechanical components, food, mouldable materials, stiff and flexible sheet materials, and textiles.

(DfE 2011f)

Research Activity

Find out more about design and technology in Key Stage 1 and Key Stage 2. For example, have a look at the section about primary design and technology on the Department for Education website: www.education.gov.uk/schools/teachingandlearning/curriculum/primary/b00198853/dt.
**Design and technology in the secondary years**

In design and technology, pupils combine practical and technological skills with creative thinking to design and make products and systems that meet human needs. They learn to use current technologies and consider the impact of future technological developments. They learn to think creatively and intervene to improve the quality of life, solving problems as individuals and members of a team (DfE 2011g).

In Key Stage 3, design and technology has a statutory programme of study, which is an important element of the wider curriculum and establishes the core entitlement for all pupils. During this Key Stage, pupils should be offered the following opportunities that are integral to their learning and enhance their engagement with the concepts, processes and content of the subject. In ways appropriate to the product area, the design and technology curriculum should provide opportunities for pupils to:

- analyse products to learn how they function
- undertake focused tasks that develop knowledge, skills and understanding in relation to design-and-make assignments
- engage in design-and-make assignments in different and progressively more complex contexts, including for purposes and uses beyond the classroom
- work individually and in teams, taking on different roles and responsibilities
- work with designers and makers where possible to develop an understanding of the product design process
- use ICT as appropriate for image capture and generation, data acquisition, capture and handling, controlling, and product realisation
- make links between design and technology and other subjects and areas of the curriculum.

(DfE 2011g)

In Key Stage 4, pupils study compulsory subjects such as English, mathematics and science, which usually involve taking GCSEs. Pupils also have to study other subjects such as ICT, which may not necessarily involve taking exams (see section on ICT above). Pupils also have opportunities to study optional subjects, including entitlement areas such as design and technology. Pupils opting to study design and technology can choose from a variety of qualifications depending on what is available in their school. In addition, selected schools offer the Diploma for 14–19-year-olds, which is a qualification that combines academic and vocational learning. There are 14 Diplomas available to schools and colleges, including ‘Information Technology’ and ‘Manufacturing and Product Design’.

**Research Activity**

Find out more about design and technology in Key Stage 3, Key Stage 4 and beyond. For example, have a look at the following sections on the Department for Education website:

- Design and technology in secondary schools: www.education.gov.uk/schools/teachingandlearning/curriculum/secondary/b00199489/dt
- GCSEs: www.education.gov.uk/schools/teachingandlearning/qualifications/gcse
- The 14 to 19 Diploma: www.education.gov.uk/a0064416/what-is-the-diploma.

**Curriculum frameworks in Northern Ireland, Scotland and Wales**

You should know the relevant National Curriculum guidelines for teaching and learning relevant to the pupils you work with. The above information curriculum relates to England. (Information about curriculum frameworks in Northern Ireland, Scotland and Wales can be found in Chapter 12.)
Chapter 14 Supporting science and technology development in children and/or young people (Unit CP 18)

Supporting children’s learning in science and technology

As part of understanding their world, children and/or young people are constantly thinking and learning – for example, gathering new information and formulating new ideas about themselves, other people and the world around them.

Developing young children’s understanding of the world

Babies and young children use their senses to: explore their environment; investigate and participate in new experiences; develop new skills and abilities; and discover how things work in the world around them. Research shows that babies are born with a wide range of sensory skills and perceptual abilities which enable them to explore their environment through hearing, sight, touch, taste and smell (Kamen 2000).

Hearing

Ears receive sounds and transmit them as signals to the brain, which makes sense of these sounds. Research has shown that babies respond to sounds before they are born. Newborn babies can hear very well (unless they are born with a hearing impairment); they prefer the sound of human voices and respond to their mother’s voice in particular (Kamen 2000).

Sight

Eyes provide people with images, but the process of seeing involves the brain’s ability to interpret these images. Each eye forms a slightly different image of what the individual sees. These two images combine to provide the person with binocular vision; thus the person can see things with depth and is able to judge the distance of objects – that is, they have depth perception. Initially, babies are unable to make both eyes work together and so have no sense of distance. Visual perception, together with improved physical coordination, enables the hands and eyes to work together (i.e. hand–eye coordination) with increasing confidence throughout the child’s early years.

Touch

Babies are born with a grasping reflex – for example, automatically gripping another person’s finger. Newborn babies can reach for objects placed in front of them but their hands may be closed before they can actually touch the object. Young babies respond to even delicate touches, such as a puff of air. Different parts of the body are more sensitive than others; the mouth and hands (especially the fingers) are particularly sensitive to touch. Babies discover new experiences through touch – for example, by handling objects and putting everything in their mouths! As they get older, children continue to use their tactile abilities to explore their environment and to discover the properties of different materials, such as rough/smooth, hard/soft, sharp/curved, and so on. The sense of touch also enables children to learn about temperature (e.g. hot/cold) and sensation (e.g. pain, pleasure, pressure).

Taste

As food dissolves in the mouth, a chemical reaction activates the taste buds, which transmit messages to the brain as to whether the food (or liquid) is sweet, sour, bitter or salty. Young babies respond to tastes in a way similar to adults; that is, they smile when tasting sweet things and frown when experiencing bitter and sour tastes. Newborn babies naturally prefer sweet tastes, like breast milk. Gradually they are able to discriminate between a range of tastes and flavours. The senses of taste and smell work together – what many people think of as tasting really involves smelling.
Smell

As a person breathes in, their nose senses the smells around them through tiny particles released by anything which has an odour. Nerve cells then transmit this information to the brain. A sense of smell is present in newborn babies; each baby can recognise the smell of her/his own mother. Babies smile when smelling sweet things like fruit and frown when smelling strong odours such as fish. As children get older, they can discriminate between wider ranges of different smells.

Activity

• Think about how young children explore their environment using their senses.
• Give examples of the sensory experiences provided for the children in your setting.

Key terms

Sensory – relating to the senses; sensory experiences enable children to make sense of the world.
Tactile – the sense of touch; the perception (or understanding) of objects through touch.

Young children’s sensory and perceptual development

Babies’ responses initially consist of automatic reflexes, such as grasping and sucking; within a few months, they are able to explore objects in more purposeful ways. Babies and young children use different strategies for exploring their environment as they mature, gaining more experience and developing their physical skills. The more opportunities they have to explore, the more they will develop their sensory skills and perceptual abilities. As their senses develop, babies and young children begin to make sense of the world around them as they perceive and process information in their environment.

To begin with, babies focus on human faces and brightly coloured objects. Later, they are able to perceive more detailed information and begin to make sense of that information. For example, being able to reach for and grasp a desired object, or telling the difference between two bricks. As well as developing their visual perception, babies gradually develop their auditory perception, from merely reacting to noise, to being able to concentrate on and make sense of specific sounds (e.g. listening to an adult’s voice without being distracted by other sounds during a story or rhyme). The young child’s visual and auditory experiences are supplemented by tactile exploration of their environment. Intellectual development is closely linked with young children’s physical development. For example, increasing mobility (from rolling to crawling to walking) enables further exploration of the environment. Developing hand–eye coordination and manipulative skills enable young children to participate in a wide range of creative and construction activities, jigsaws and games. These activities assist children’s powers of observation, perception and imagination. (See section on developing imagination and creativity in Chapter 11.)
**Key terms**

- **Auditory perception** – the processing and interpretation of sound as meaningful information.
- **Visual perception** – the ability to process and interpret information using the eyes.

Table 14.1 outlines the general sequence of very young children's sensory and perceptual development. Remember that the ages referred to in the chart are only guidelines to expected development. Some children will acquire these sensory skills and perceptual abilities earlier and others later than indicated.

<table>
<thead>
<tr>
<th>Age of discovery</th>
<th>The sequence of young children's sensory and perceptual development</th>
</tr>
</thead>
</table>
| 0 to 3 months    | • In first month, babies' responses are reflexes, e.g. sucking, grasping  
|                  | • Learns to modify reflex responses  
|                  | • Alert to voices when awake  
|                  | • Blinks when surprised or alarmed  
|                  | • Can focus 18 to 23 centimetres  
|                  | • Can distinguish between light and dark  
|                  | • Responds to bright light and bold colours (not pastels)  
|                  | • From about two months, can discriminate between shades and colours  
|                  | • Can focus further, and images become clearer as eye muscles become trained  
|                  | • Recognises faces of well-known adults and responds with smiles and arm movements  
|                  | • Looks around purposefully and responds to visual stimulation by smiling and/or reaching out towards objects, e.g. mobiles, activity centres, board books, plastic mirrors, etc.  
|                  | • Repeats basic actions, e.g. thumb/fist sucking, wiggling fingers  
|                  | • Reacts to prolonged noises, such as washing machines or vacuum cleaners. |
| 3 to 9 months    | • Can focus more accurately, taking in more visual detail  
|                  | • Follows the progress of moving objects  
|                  | • Enjoys bright, bold patterns; starts to notice different patterns  
|                  | • From about five months, begins to perceive differences between objects, e.g. size, shapes, colours  
|                  | • Can discriminate between different facial expressions  
|                  | • Quiets or smiles in response to parent’s/carer’s voice; turns head towards voice  
|                  | • Developing curiosity encourages them to adjust their own position to look at objects  
|                  | • Still puts things in mouth, but fingers used increasingly often to explore objects  
|                  | • Responds to visual stimuli by touching, e.g. activity centre, hitting mobile  
|                  | • Reaches out and grasps objects, e.g. shakes rattle to make a noise  
|                  | • Rolls towards desired object; once can crawl will do this to reach object  
|                  | • Enjoys putting things in containers and taking them out again  
|                  | • From about eight months, begins to understand object permanence, e.g. if drops a toy, will look in appropriate direction for it  
<p>|                  | • By about nine months, listens attentively to everyday sounds and reacts to quiet sounds out of sight. |</p>
<table>
<thead>
<tr>
<th>Age of discovery</th>
<th>The sequence of young children's sensory and perceptual development</th>
</tr>
</thead>
</table>
| 9 to 18 months   | • Can focus like an adult, but still learning how to interpret visual information  
                     • Can follow objects moving quickly with eyes and see them clearly  
                     • Will physically follow a moving object if mobile and reach for it; if not yet mobile, will point to an object out of reach  
                     • Experiments with toys and everyday objects to see what will happen; still puts things in mouth, but uses fingers more to explore objects and what can be done with them  
                     • Enjoys stacking, posting and/or pulling toys  
                     • Enjoys finger rhymes and clapping games such as pat-a-cake  
                     • As becomes more mobile, physically explores environment – watch out!  
                     • Responds to own name and other familiar words such as ‘no’ and ‘bye-bye’  
                     • From about 12 months, scribbles with crayons; enjoys sensation of finger painting. |
| 18 months to 2 years | • May be able to concentrate on short stories with clear pictures  
                         • Enjoys pop-up/novelty books with flaps (needs supervision)  
                         • Continues to develop visual perception and hand–eye coordination through activities which involve sorting and matching, e.g. simple in-set jigsaws, three-to-four piece jigsaws, building towers, sorting bricks, etc.  
                         • Continues to scribble with crayons and enjoys tactile/visual qualities of paint  
                         • Able to use symbols in play activities, e.g. doll represents a real baby  
                         • Increased mobility/coordination allows further exploration of their environment  
                         • Visual memory increases, e.g. can remember where favourite things are kept (and have physical ability to go and get them!) |
| 2 to 3 years      | • Desire to explore continues  
                         • Enjoys ‘hide and seek’ games, e.g. hiding toys to find  
                         • Continues to develop visual perception and hand–eye coordination through doing more complex jigsaws, sorting/matching activities, modelling, construction  
                         • More confident with crayons; using paintbrush as well as finger/sponge painting  
                         • Enjoys looking at books with clear illustrations  
                         • Can identify different letters of the alphabet and match some letters when asked  
                         • Increasingly uses language to discover what is going on, e.g. asking questions and listening to conversations of others, listening to stories. |
| 3 to 4 years      | • Visual perception continues to improve as physical coordination develops through creative play, construction activities, threading, jigsaws, etc.  
                         • Pencil control improving: learns to use scissors and other simple tools  
                         • Developing colour and shape recognition  
                         • Continues to enjoy books with clear, meaningful illustrations related to their own interests, e.g. babies, families, animals, dinosaurs, etc.  
                         • Developing observational skills through exploration of environment, e.g. looking through simple binoculars  
                         • Curiosity increases along with ‘who, what, why, when, how’ questions  
                         • Auditory perception develops through activities such as listening to stories, joining in with songs/rhymes and other simple musical activities. |
Chapter 14 Supporting science and technology development in children and/or young people (Unit CP 18)

• Observe a young child engaged in an activity which encourages sensory exploration.

• In your assessment, focus on: which senses were used by the child; the child’s responses, including any language used; the child’s concentration level; the physical skills demonstrated by the child (e.g. hand–eye coordination, manual dexterity, mobility).

• Suggest how you could encourage or extend the child’s development.

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Table 14.1 Sensory and perceptual development

<table>
<thead>
<tr>
<th>Age of discovery</th>
<th>The sequence of young children’s sensory and perceptual development</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 to 5 years</td>
<td>• Continues to develop observational skills through detailed examination of their environment, e.g. using binoculars, magnifying glasses and telescopes</td>
</tr>
<tr>
<td></td>
<td>• Visual perception and hand–eye coordination improved through activities such as painting, drawing, writing, lotto, dominoes and jigsaws</td>
</tr>
<tr>
<td></td>
<td>• Continues to develop visual memory through activities, e.g. ‘matching pairs’</td>
</tr>
<tr>
<td></td>
<td>• Awareness of signs in local environment, e.g. street names, shop signs and road signs</td>
</tr>
<tr>
<td></td>
<td>• Developing auditory perception through listening activities, e.g. sound lotto, ‘what’s that sound?’ games and musical activities</td>
</tr>
<tr>
<td></td>
<td>• Improved physical skills lead to interesting climbing and swinging activities</td>
</tr>
<tr>
<td></td>
<td>• Discovering more about their world through language, television and books.</td>
</tr>
<tr>
<td>5 to 7 years</td>
<td>• Continues detailed exploration of the environment</td>
</tr>
<tr>
<td></td>
<td>• May be interested in maps and plans, e.g. layout of classroom, school, local streets, atlases, including making own maps and plans</td>
</tr>
<tr>
<td></td>
<td>• Discovers more about own abilities through physical activities such as running, jumping, climbing, throwing and catching; increasingly competitive</td>
</tr>
<tr>
<td></td>
<td>• Continues to use language to discover more about their environment and how things work, but also interested in why people do things</td>
</tr>
<tr>
<td></td>
<td>• Shows particular interest in sources of information, e.g. television, computers, books, encyclopaedia, museums</td>
</tr>
<tr>
<td></td>
<td>• As hand–eye coordination and manipulative skills develop, further skills such as writing, drawing and painting also improve</td>
</tr>
<tr>
<td></td>
<td>• Auditory perception improves through listening to stories, participating in singing and other musical activities.</td>
</tr>
</tbody>
</table>
Ten ways to encourage young children to explore and understand their environment

1. Provide plenty of opportunities and materials to increase curiosity – for example, treasure baskets, posters, pictures, books, games, toys and other play resources.

2. Encourage them to be observant by pointing out details in the environment – for example, colours, shapes, smells and textures; interesting objects such as animals, birds and vehicles; talking about weather conditions; taking them on outings; gardening; keeping pets.

3. Provide opportunities and materials for exploratory play – for example, sand play exploring the properties of sand (e.g. wet sand sticks together and can be moulded, while dry sand does not stick and can be poured); water play with plain, bubbly, coloured, warm or cold water helps children learn about the properties of water (e.g. it pours, splashes, runs, soaks). For both sand and water play, provide small containers and buckets to fill and empty, as well as sieves and funnels.

4. Encourage tactile exploration through activities which involve exploratory play, such as handling sand, water, clay, dough, wood and other modelling materials like clean household junk (empty boxes etc.) and manufactured materials (e.g. wooden and plastic construction kits), as well as making collages using different textures or playing games using a ‘feely’ box or bag.

5. Provide opportunities for repetition as well as gradually more challenging activities by encouraging children to play with materials, toys and games more than once; each time they play, they will discover different things about these activities. However, do not push children too hard by providing activities which are obviously too complex – rather than extending children’s abilities, this will put them off due to the frustration of not being able to complete the activity.

6. Encourage auditory perception through activities such as: singing rhymes and songs; clapping games; awareness of animal noises and environmental sounds; listening to songs, rhymes, music, stories and everyday sounds on CDs; sharing books and stories; playing sound lotto; identifying musical instruments; speaking and listening activities (e.g. phonics).

7. Encourage visual perception through activities involving exploration of the environment, including outings to the park, a farm or nature reserve; looking at books, pictures, displays and photographs; using magnification to highlight details (e.g. magnifying glasses, binoculars and telescopes); playing matching games; playing with jigsaws; observing details using mirrors; participating in activities requiring letter and/or number recognition, including simple board games.

8. Encourage use of taste and smell senses through activities such as: cooking; finding out about different tastes – sweet, sour, bitter, salty; finding out about different smells – sweet and savoury, fruit and vegetables, flowers.

9. Participate in children’s play to extend their learning by asking questions, providing answers and demonstrating possible ways to use equipment when the child is not sure what to do. For example, a child can become very frustrated when struggling to do a jigsaw, but make sure your help is wanted (and necessary); use verbal prompts where possible to encourage children to solve the problem themselves.

10. Remember safety at all times. It is important to allow children the freedom to explore their environment and to experiment with the properties of different materials. However, make sure that these materials are suitable for young children (e.g. objects which can pose a choking hazard or glass objects which could be broken causing cuts must be kept well out of the reach of young children). (See section below on ‘Maintaining children’s safety during science and technology activities’ on page 37.)
The importance of exploratory play

Exploratory play encourages and extends children’s discovery skills. Play is an important way to motivate children and to assist their thinking and learning in a wide variety of settings. Children (and young people) learn from play situations that give them ‘hands-on’ experience. Exploratory play encourages children to use their senses to discover the properties of different materials in pleasurable and meaningful ways. For example, playing with sand encourages children to consider textures and the functions of sand, such as getting the right consistency of sand to build sandcastles – too wet or too dry and the sand will not stick together.

Exploratory play enables children to:

- understand concepts such as shape and colour
- explore the properties of materials (e.g. textures)
- understand volume/capacity and physical forces through sand and water play
- develop problem-solving skills
- devise and use own creative ideas.

Play allows children to explore their environment in non-threatening ways which are less damaging.

In Practice

Plan an experience to encourage a young child’s understanding of the world. You could use your suggestions from the observation on page 13 as a starting point. A suitable experience might be:

- providing an opportunity for exploratory play (e.g. sand/water play, model-making)
- providing a visual stimulus for a baby, such as a mobile or activity toy/centre
- devising a musical activity or sound game to encourage auditory perception
- designing a tactile activity, such as a ‘feely’ box/bag or treasure basket
- implementing a cooking or tasting session (remember safety, food allergies and dietary restrictions)
- organising an outing where the focus is on exploring the environment using the senses (e.g. visit to local park, nature centre/trail; going on a ‘bug hunt’).

Include suggestions for enhancing the development of a child with a hearing or visual impairment and a child with a community language other than English. Review and evaluate the experience afterwards.

Figure 14.3 Children exploring and experimenting with materials (© Andrew Callaghan)
to their self-esteem than more formal learning situations which involve right and wrong answers. Play enables direct learning through ‘hands-on’ experiences, often involving ‘trial and error’ methods. We all experiment with new objects or situations. Adults will ‘play’ with new equipment (such as a television, DVD recorder or music system) – for example, pushing buttons to see what they will do, even before we have read the instructions. Adults and young people have more experiences and knowledge to draw on to make sense of new situations and can usually read to gain additional information. Young children have fewer experiences to refer to, so require more exploration and experimentation to make sense of the materials in the world around them.

**Activity**

- Think about what you do when you have a new machine/gadget, or when you visit a new place (e.g. checking out holiday accommodation).
- Give examples of exploratory play from your own experiences of working with children.

**Supporting children’s learning in science**

Science relies on the ability to understand abstract ideas. For example, young children need to develop a sound knowledge and understanding of concrete concepts, such as shape, colour, textures and physical forces, before they can develop an understanding of...
more abstract concepts, such as time and physics. Experiences with real objects enable young children to develop problem-solving skills and to acquire understanding of these concepts. Adults working with young children need to ensure that they provide activities at the appropriate level for the children’s conceptual development. There should be a balance between encouraging the children to develop their own problem-solving skills through play with minimal adult intervention and complying with the early learning goals for ‘understanding the world’ or the objectives for the National Curriculum in science.

Every setting should aim to develop each child’s understanding of the world around them by building on their natural curiosity and introducing them to scientific processes and ideas from an early age. Children’s scientific skills can be developed through a wide range of practical activities, both indoors and outdoors. Science resources may be organised into topic boxes. For example: exploring materials; plants; animals; circuits; weather; sound; light and colour.

Equipment may include: batteries, battery holders, bulbs, bulb holders and wires for circuits; lamps, bells, motors and buzzers; wheeled toys; mirrors (plastic), prisms, colour filters, torches; metre sticks, measuring tapes, kitchen and bathroom scales, compasses, thermometers; binoculars, magnifiers, hand lenses, microscopes; elastic bands, springs; a selection of magnets.

Materials may include: a selection of flowering and non-flowering plants, seeds, fruits and bulbs; clay, sand, different types of rocks; samples of manufactured materials (e.g. concrete, glass, metals, plastics); objects made from natural materials (e.g. cotton, leather, wood, wool); a range of magnet materials; materials from the bathroom or kitchen (e.g. bath salts, bicarbonate of soda, coffee, flour, oil, salt, sugar, vinegar); empty boxes, containers, tubes, scrap card, corks, sponges, cotton wool.
## The provision of science activities

Providing plenty of opportunities for children to observe, investigate, predict, hypothesise and record by encouraging these skills in exploratory play and simple science experiments, including pictures and diagrams.

## Examples of children engaged in science

### Figure 14.6a © Andrew Callaghan

Providing plenty of opportunities to discuss topics related to science, such as: circle time; story time; problem-solving during activities; follow-up to activities (e.g. after television programmes or stories); cooperative group work; games and puzzles; talking about key features when on outings.

### Figure 14.6b © Andrew Callaghan

Sharing books, stories, poems and rhymes to introduce children to different scientific concepts (such as colour, shape, texture, plants and animals, energy, weather, people and places), including picture books, storybooks, ‘big’ books, novels, poetry books, information books, dictionaries, encyclopaedias and atlases.

### Figure 14.6c © Andrew Callaghan

Encouraging children to participate in appropriate opportunities for play, especially activities that encourage curiosity and exploration (e.g. exploratory play such as sand and water play, model-making and creative activities).
The provision of science activities

Using displays as a stimulus for discussions and to consolidate learning. For example, wall and interactive table-top displays with interesting objects to talk about, look at and/or play with, as well as recorded sounds to listen to, including voices, music, songs, rhymes and musical instruments.

Examples of children engaged in science

Encouraging children to participate in games to develop auditory discrimination, like sound lotto and ‘guess the sound’, using sounds of everyday objects or musical instruments.

Encouraging children to participate in matching games and memory games to develop visual discrimination and memory skills. For example, snap, matching pairs, jigsaws and games like ‘I went shopping…’ or ‘I spy…’ using colour or shapes; going on a ‘colour or shape hunt’ (looking around the classroom for things of a particular colour or shape); using simple maps to discover more about their local environment.

Table 14.2 Children participating in science activities
Activity

Observe a young child during a science activity. Then answer these questions:

- Did the child achieve the learning objectives set? If not, why not?
- If the child has achieved the learning objectives, what effect has it had (e.g. on the child’s behaviour, learning, any special need)?
- Were the learning objectives too easy or too hard for the child?
- How did any staff involvement affect the child’s achievement?
- Was the activity plan successful? If not, why not?

Opportunities to support children’s learning in science

1. Observing shapes and patterns in the setting and the wider environment, including exploring shapes during model-making, collage and other creative activities.

2. Exploring space and shapes during outdoor and physical play, PE and movement sessions by looking at body shapes and how they move with and without apparatus.

3. Participating in creative activities, including collage, colour-mixing and making rainbows; exploring colour through interest tables/displays or themed weeks with books, stories and songs linked to colours.


5. Talking about colours in the environment (e.g. traffic lights, blue lights for emergency vehicles) and how plants and animals use colour (i.e. to attract insects for pollination or to hide from predators).

6. Engaging in tactile experiences such as sand and water play, collage, touch table, ‘feely’ bag/box, play dough, clay and cooking sessions.

7. Singing songs and rhymes about ourselves and the human body (e.g. ‘I’ve got a body, a very busy body….’ and ‘Head, shoulders, knees and toes….’); doing topics about babies.

8. Studying animals and plants by visiting nature reserves, wildlife centres, parks and farms; keeping pets; growing seeds like beans, mustard and cress; having a nature table. Remember health and safety issues. (See section on page 37 on ‘Maintaining children’s safety during science and technology activities’.)

9. Using toys to explore ideas about energy (e.g. pulling, pushing, pull-back, wind-up, battery, remote-controlled and electrical toys).

10. Observing and talking about different weather conditions; keeping a weather chart; making toy windmills; making paper snowflakes; sharing weather stories and rhymes; discussing temperature differences like hot and cold; deciding on suitable clothing to wear in different weather conditions.

11. Experimenting with different objects to see which will float or sink, using questions to encourage predictions – for example, will all heavy objects sink? Will all light objects float? What happens if you change an object’s shape (i.e. plasticine in a ball sinks, but when shaped as a bowl or boat it floats)?

12. Exploring the changing state of materials (i.e. frozen water is ice) by making ice lollies.
Supporting children’s learning in ICT

Children need to be able to use information and communication technology (ICT) to support their learning across all areas of the relevant curriculum framework. Developing ICT skills helps prepare children for a world that is rapidly being transformed by technology. They need to learn the ICT skills necessary for work and everyday life (e.g. using the internet and email or computer programs for business, home and study). Using ICT can help to promote children’s early learning by helping them to learn how to control a computer, including word processing, developing pictures using ‘paint’ software, making tables or graphs, and accessing information via the internet.

You can use ICT to support play and learning in other curriculum subjects in ways that are stimulating and enjoyable for children, according to their ages, needs and abilities. You should work in partnership with families to support children’s learning through ICT, including providing opportunities for families to participate in ICT provision (e.g. ICT workshops, parent helpers for ICT activities).

The setting should have a wide range of resources for supporting ICT. Computer hardware and accessories include computers, printers, scanners, PDAs, notebooks, adapted keyboards, computer-activated toys, concept keyboards, touch screens, digital cameras and digital projectors. Computer software includes CD-ROMs, and data-handling and word-processing programs. Children should be provided with access to up-to-date computer systems that are connected to the internet (used under strict supervision).

Activity

1. Suggest ways to support the development of children’s scientific skills. Use your own experiences of working with children if possible. You could use your observation of a young child during a science activity as the starting point for this.

2. Visit a farm, park, nature reserve or wildlife centre in your local area. What animals and/or plants can be observed there? Do they have an educational department and/or provide science workshops for children?

3. Think about how you could use such a visit to develop the scientific skills of the children in your setting.

Figure 14.7 A child enjoying a visit to a farm (© Jeno – Fotolia)
The provision of ICT activities

Using ICT to find out information and how to share and exchange this information.

Handling computer hardware and software (e.g., how to use a word processor and programs such as 'paint').

Saving information on computers, presenting it in different ways and talking about how ICT can be used in everyday lives.

Feeling comfortable using computer software in everyday work (e.g. write and edit class work using a word processor or make use of computer graphics).

Examples of children engaged in ICT

Figure 14.8a © Monkey Business – Fotolia

Figure 14.8b © Vadim Ponomarenko – Fotolia

Figure 14.8c © pressmaster – Fotolia

Figure 14.8d © bst2012 – Fotolia
The provision of ICT activities

Using the techniques they have learnt to produce their own books and other materials.

Using programmable toys (e.g. put together computerised instructions in the right order).

Examples of children engaged in ICT

Using the techniques they have learnt to produce their own books and other materials.

The three little pigs decided to get away from it all

Figure 14.8e © Storybird (http://storybird.com/)

Using programmable toys (e.g. put together computerised instructions in the right order).

Figure 14.8f © Andrew Callaghan

Table 14.3 Children participating in ICT activities

Activity

1 Observe a child engaged in an ICT activity.

2 In your assessment focus on: the learning intentions/goals achieved by the child (e.g. learning new skills, solving problems or finding new information); the child’s use of the ICT equipment; any difficulties the child had in understanding or completing the ICT activity; the strategies used to support the child during the ICT activity.
Opportunities to support children’s learning in ICT

1. Encouraging children to find out about different ICT equipment and their uses (e.g. photocopier, digital camera, answer machine, scanner, walkie-talkies).

2. Setting up a role-play area to encourage interest in ICT (e.g. airport check-in, dentist reception, office or supermarket role-play area).

3. Using ICT equipment to stimulate interest and prompt discussion (e.g. display photographs taken with a digital camera; make a slideshow of photographs).

4. Encouraging children to use the ICT equipment available as independently as possible (e.g. using a digital camera to take photographs, opening an image on a computer and printing out).

5. Demonstrating how to use a paint programme and encourage children to create their own pictures using it.

6. Facilitating free play using ICT (e.g. remote-controlled cars and trucks in the outside play area).

7. Encouraging children to investigate moving a programmable toy, including using the language of direction – forwards, backwards and turn.

8. Providing opportunities for children to explore the functions of an electronic musical keyboard.

9. Demonstrating how to use a cassette player or CD player so that children can listen to music or talking books by themselves.

10. Demonstrating how to use interactive books on the computer and provide opportunities for children to explore these independently.

11. Providing opportunities for children to use computer software in their everyday work (e.g. use a word processing or presentational program to present their work).

12. Using ICT as communication aids for children (e.g. computers and adapted keyboards or concept keyboards for children with special needs).

Figure 14.9 A child using ICT in a local library (© Rob – Fotolia)
1 Suggest ways to support the development of children’s ICT skills. Use your own experiences of working with children if possible. You could use your observation of a child involved in an ICT activity as the starting point for this.
2 Visit a local library. What types of ICT does the library offer to library users? Does the library have an educational department or provide ICT workshops for children and/or their parents?
3 Think about how you could use a visit to the library to develop the ICT skills of the children in your setting.

**Safety issues for using ICT resources**

You should find out which ICT equipment is needed and when it is required. You will need to ensure that this equipment is available and ready for use at the time required. You may need to book equipment in advance if it is shared between groups/classes, or check and set up equipment already in the room where you work. You will also need to make sure that accessories and consumables (e.g. printer paper or spare bulbs) are the correct ones for the equipment being used. These should be stored safely but with easy access for when they are required. You should check that ICT equipment is in safe working order and is being used correctly by yourself and the children. After use, make sure that the equipment is left safe and secure. Any faults with equipment should be promptly reported to the person responsible for arranging maintenance or repair. You must make sure that any faulty equipment is made safe and secure until it can be removed and/or repaired. The setting should also have guidelines for the use of ICT, including information on preventing access to unsuitable material via the internet and maintaining the safety of children who access the internet.

**Activity**

1 What are your setting’s procedures for the safe use and storage of ICT equipment?
2 Outline your setting’s guidelines for the use of ICT, including information on:
   - how you prevent access to unsuitable material via the internet
   - how you maintain the safety of children who access the internet.

**Supporting children’s learning in design and technology**

Design technology involves using and applying skills and knowledge from other subjects such as mathematics, science and/or art. In design technology, children learn and practise a variety of skills, including:

- identifying problems and design needs
- suggesting possible solutions
- implementing these solutions
- evaluating the effectiveness of their solutions.

The setting should have a wide range of resources for supporting design and technology, both indoors and outdoors. Many of the resources for art and design will also be appropriate for this area of the curriculum. The setting should have a supply of essential materials and equipment for design and technology. For example, construction materials, including: art straws, cotton reels, pipe cleaners and textiles; construction tools and equipment, such as adhesives, glue gun (low temperature for safety), hammer, pliers and scissors. Additional resources for design and technology should also be available as appropriate to topics or themes. These might include: axles, batteries, bulbs, buzzers, connectors, dowels, fasteners, gears, magnets, motors, plastics, pulleys, switches, gears and wood.
The provision of design and technology activities

Developing ideas for design and technology products.
Talking about these ideas and planning what to do next using pictures, words and models.
Choosing and safely using the tools, equipment and techniques they need for their ideas.
Assembling materials and components in different ways.
Talking about how they could improve their work in the future.

Table 14.4 Important stages for children participating in design and technology activities

Activity

1. Observe a child involved in a design and technology activity.
2. In your assessment, comment on the child’s: language and communication skills; auditory discrimination; imaginative/creative skills; concentration level; memory skills. You might also consider the emotional value of the activity. Also comment on the level of adult support provided during the activity.
3. Suggest ways to encourage and extend the development of the child’s design and technology skills.

Figure 14.10 Examples of children using tools and materials in a design and technology activity

© Andrew Callaghan

Opportunities to support children’s learning in design and technology

1. Providing opportunities for children to explore and develop ideas. For example, arranging a walk around the setting or local area and encouraging the children to look at design features.
2. Providing opportunities for the children to observe carefully the shapes and textures of natural and manufactured objects: using magnifying glasses to find interesting qualities; looking at the lines, shapes...
and colours in the objects; displaying a selection of natural objects (e.g. plants, seed pods, roots, leaves, flowers, fruits, vegetables) and manufactured objects (e.g. construction kits/models, 2D and 3D shapes, beads and buttons, mosaics, straws).

3. Providing opportunities for children to investigate and make, for example: making careful drawings of natural objects; choosing one of their drawings to develop into a design for a textile collage; choosing the main fabrics they would like to use in their collage; helping them to develop a fabric collage.

4. Providing opportunities for children to evaluate and develop their work, for example: talking about how they made their collage; identifying successful features in their own work and the work of their peers.

5. Looking at examples of designs based on nature and natural forms from different times and cultures. Discuss the use of line, shape, colour and texture and suggest ways in which the designs have been adapted to the materials.

6. Looking at and talking about familiar products (made of materials such as card, textiles and food) to see how they work.

7. Designing and making their own products, using what they have learned. For example, looking at various toys and asking questions: How was the toy put together? What type of material was used? Who was the toy made for? Practise skills, such as cutting and joining the kinds of materials used in the toy. Finally, they design and make their own simple toy (e.g. puppet).

8. Experimenting with a variety of materials, tools and techniques (e.g. painting, printmaking, modelling clay). Practise simple practical skills, such as cutting, folding and gluing, which they will use as they make their own products.

9. Reviewing their own and others’ work, saying what they think and feel about it; commenting on differences in others’ work; suggesting ways of improving their own work.

10. Finding out about differences and similarities in the work of craftspeople and designers in different times and cultures. For example, looking at a range of work from different sources (e.g. during visits to craft fairs or on the internet).

11. Working as individuals and working with others, using a range of starting points (e.g. their own experiences, natural and made objects, as well as the local environment).

12. Remember to follow the school’s health and safety guidelines. (See section on page 37 on ‘Maintaining children’s safety during science and technology activities’.)

### Activity

1. Suggest ways to support the development of children’s design and technology skills. Use your own experiences of working with children if possible. You could use your observation of a child involved in a design and technology activity as the starting point for this.

2. Visit a local venue with links to technology (e.g. a science museum or living museum). What types of hands-on technology experiences does it provide? Does the venue have an educational department or provide workshops for children?

3. Think about how you could use a visit to this venue to develop the design and technology skills of the children in your setting.
The benefits of science and technology learning for children and young people

What is the importance of teaching science and technology to children? Science and technology learning ultimately comes down to trying to spot patterns, work out reasons for them, and to spot errors and mistakes – these are all important life skills. Opportunities to learn about the ideas and reasons behind accurate formal writing, using good judgement, formulating rules, testing ideas, parsimony and bias provide children with an excellent introduction to the scientific method, but also to thought itself. Science and technology teaches children how to think, how to evaluate and judge, how to process information and come to rules and conclusions about the world – giving them a powerful set of tools that will literally last them a lifetime. The benefits of science and technology learning are clear if the children have an established concept of how to present and test their ideas independently and how to evaluate material put in front of them, as well as having something to take outside the classroom for the future (Hone 2008).

Science and technology promotes children’s learning by enabling children to:
- access, select and interpret information
- recognise patterns, relationships and behaviours
- observe, explore and describe patterns in number, shape and data
- develop problem-solving skills, including logic and reasoning
- experiment and gain knowledge from feedback
- model, predict and hypothesise
- test reliability and accuracy
- review and modify their work to improve the quality
- communicate with others and present information in a variety of ways
- be creative and imaginative
- gain confidence and independence.

The benefits of science learning for children and young people

Education should be a natural and enjoyable part of life – like playing should be part of every child’s life. Creativity and imagination are as important as factual knowledge. Teaching children to ‘think outside the box’ is far better than expecting them to learn by rote or memory. There are lots of opportunities for children to see science concepts first hand when playing. For example, children can: run around like atoms; jump up and down to demonstrate gravity; spin while walking in circles around a single child (representing the sun), pretending to be planets in orbit; race balloon cars to experiment with speed over different distances; make mud pies; drop balls into water to see displacement at work; explore the senses through games. As well as making direct links with scientific concepts, play-based learning can easily support the development of a range of scientific enquiry skills. The application of logic plays a part in most childhood games – assessing a situation, making a decision and then acting upon that decision are all essential skills for a successful scientist. Similarly, the role of problem-solving during play cannot be understated as an opportunity to develop science skills (Sinclair 2008).

The benefits of developing science skills for children and/or young people

1. Science responds to children’s needs to learn about the world around them. The main reason for a science-based early childhood curriculum is that children love it. Disruptive behaviour diminishes as children become engaged in explorations. Conversation and cooperation increase as children talk with one another about their predictions, observations and questions.
2. Children’s everyday experience is the foundation for science. For example, the concept and process of ‘change’ can be explored by making scrambled eggs. Children know what raw and scrambled eggs look like, but may have never watched the transformation take place. Focusing on the process of cooking the egg offers a new way of considering familiar objects and events and provides a meaningful context within which to introduce new vocabulary and science concepts.

3. Open-ended science activities involve children at a wide range of developmental levels. Within any activity, there are a variety of levels at which children can engage, depending on their prior knowledge and skills. For example, when using water-droppers to mix coloured water, one child may spend 20 minutes practising the fine motor skills for operating a water-dropper, while another child may spend an equal amount of time exploring how to use proportions to create different shades of orange. As children can find their own level within such an activity, they are challenged without becoming frustrated or bored.

4. Hands-on science activities let practitioners observe and respond to children’s individual strengths and needs. As practitioners observe children finding their own level within an open-ended activity, they can become more aware of what each child knows and what they may need some assistance with. For example, the child who practised fine motor skills with a water-dropper may enjoy more tasks to strengthen that skill or may be ready to repeat the activity at a higher conceptual level (that is, focusing on creating colours).

5. The scientific approach of ‘trial and error’ welcomes error by interpreting it as valuable information, not as failure. Achievement increases when children are free to focus on learning rather than on avoiding mistakes.

6. Science strongly supports language and literacy. Children learn language through participation in meaningful, comprehensible, language-based interactions. Appropriately implemented, a science-based curriculum is rich in language use by both adults and children. Literature of all kinds can be used to support a science-based curriculum. Songs, finger-plays, poems and books can be matched to the activity and used to support it.

7. Science helps children learning English as an additional language to participate in the setting and learn English. Practical demonstrations and hands-on activities with familiar materials enable children who come from a home where little or no English is spoken to understand a great deal of the content without understanding the practitioner’s language. Their understanding of the situation helps them learn English.

8. The problem-solving skills of science easily generalise to social situations. Practitioners can help children adapt the cycle of problem solving to interpersonal problems. They can help children to plan some possible solutions and to predict what might work best, then encourage them to try the proposed solution and let the practitioner know how it worked. The practitioner can then help them to try something else if the first attempt did not work.

9. Science demonstrations help children to become comfortable in large group conversations. When the practitioner makes orange by combining red and yellow, children are amazed and ask how and why it happened and what would happen if other colours were mixed. The practitioner can support and extend a large group conversation of this sort for several minutes, and then suggest ways for children to explore the questions they have generated. When demonstrations and discussions take place in a large group setting, the children
The benefits of technology learning for children and young people

Technology is now such an important part of children’s everyday lives that a learning environment without it would be completely out of touch with real life. ICT is a fantastic motivator and enabler, but it is necessary to choose only the technology that will enhance learning and not to simply use it for its own sake. Using appropriate technology provides opportunities to develop independent learning skills. For example, a box of defunct technology equipment was placed outside near to some cardboard boxes, plastic containers and other modelling equipment; before long, children were adding the battered old keyboards and computer ‘mice’ to their models, making all manner of interesting spaceships and robots. Such experiences could easily be the focus for creative learning. Without a specific stimulus, many children find it difficult to generate their own ideas from imagination alone. But when the basis of a role-play, story or explanation comes from something they have made and seen, it becomes easier for them to think of ideas and to link events together. ‘What is your spaceship called?’, ‘Who flies it?’, ‘Where is it going?’, ‘What might it meet on the way?’, ‘When the spaceship lands, what is the place like?’ Questions like these can help unlock children’s imaginations and develop their creativity (Andrews 2008).

Similarly, the use of ICT helps to remove the boundaries between learning and experiences that take place in home and at school. Children might not be able to take home their model robots or spaceships, but they can take a digital camera picture, print it out, and discuss what they did with their family later. Out in the garden or at a friend’s house, they might even be able to come up with some more exciting adventures for their intrepid spaceship crew, or devise obstacles for their hapless robot to overcome. Digital photography can also boost a child’s self-esteem, celebrate children’s interests, cultures and beliefs, challenge their thinking and help provide personalised resources. Children can capture images and see them through the display in the camera; they can take photographs of things they like and dislike; they can photograph their friends and be photographed themselves. Often, quiet and withdrawn children can smile spontaneously as they see themselves in photographs, and be encouraged to speak in a familiar group (Andrews 2008).

Computers and other associated technology are now part of everyday life, so it is as important for all children to become computer-literate as it is for them to develop traditional literacy and numeracy skills (see Chapter 13).
The benefits of developing technology skills for children and/or young people

1. Stimulating imagination and creativity: children can take their experiences of the world and transform these by making new connections and relationships through their inventive minds. Their knowledge, memories and fantasies all feed their imagination; design technology allows children to explore, build on and record their own creative and imaginative ideas.

2. Developing observational skills: making models helps children observe more closely the subject matter from the real-world scene they are drawing from, and therefore makes them more observant of the details in the world around them. Together with visual thinking, developing observational skills through model-making facilitates the child’s visual sensitivity of the world.

3. Learning problem-solving and analytical skills: making models enables children to explore and test out ideas, while making decisions on how they choose to design them. For instance, children will learn problem-solving skills as they try to create 3D models from 2D drawings, diagrams or plans. With practice, children learn that with concentration and persistence, they can produce more successful models of what they are trying to achieve.

4. Increasing autonomy: a child’s design is his or her own. It has worth in its own right, without having to be measured or judged by others as right or wrong. The child has the authority to say what the design is of, or what it communicates, therefore building up the child’s confidence and self-esteem.

5. Using ICT to encourage or extend children’s literacy and numeracy skills: ICT across the curriculum, including television, CD-ROMs and the internet, can act as additional stimuli for discussions and ideas. ICT can also be used to introduce or reinforce information on topics and themes within the setting. Remember that ICT is not a substitute for other forms of communication, such as conversation and children’s play.

6. Computers can make learning more attractive and interesting, providing a different, more visual way of developing and using literacy and numeracy skills. For this reason, computers can be particularly helpful for children with language, literacy, numeracy or learning difficulties, especially as computer programs often have in-built praise or reward systems to motivate the user.

7. Word processing can enable children to write more easily and clearly, giving them freedom from the physical constraints of pencil control and encouraging correct spelling through the use of a spell-checker.

8. ICT can be used to find, develop, analyse and present information: ICT enables rapid access to ideas and experiences from a wide range of people, communities and cultures, and allows pupils to collaborate and exchange information on a wide scale.

9. ICT acts as a powerful force for change in society and citizens, understanding the social, ethical, legal and economic implications of its use, including how to use ICT safely and responsibly.

10. Increased capability in the use of ICT supports initiative and independent learning: children are able to make informed judgements about when and where to use ICT to enhance their learning and the quality of their work.
Research Activity

Analyse the benefits of science and technology learning for young children. You could start by looking at the following:


Section 2: Understand learning needs of individual children and/or young people when supporting the development of science and technology

Effective planning for children’s early learning is based on each child’s individual needs, abilities and interests; this is why accurate observations and assessments are so important. These needs have to be integrated into the curriculum requirements for your particular setting and the age group(s) of the children you work with – for example, in England, the Early Years Foundation Stage or the National Curriculum (see from page 1). The curriculum sets out the standards to be used to measure the progress and performance of children/young people in each subject, to help practitioners to plan and implement learning activities that meet the individual learning needs of the children and/or young people they work with. (Detailed information about curriculum planning is in Chapter 12.)

Possible or potential individual learning needs in relation to science and technology for visual, auditory and kinaesthetic learners

Children and young people have different ways of processing information. They use the skills of looking, listening or touching in varying amounts depending on their individual learning style. For example, some children require visual stimulation (visual learners), some respond well to verbal instructions (auditory learners), while others need more ‘hands-on’ experiences (kinaesthetic learners). In addition, different times of the day affect individual levels of concentration; some children work better in the morning, others in the afternoon. You need to be aware of the individual learning styles of the children you work with in order to plan and provide appropriate learning activities. Recognising

Visual learners: visual learners learn through seeing. These learners need to see the teacher’s body language and facial expression to fully understand the content of a lesson. They tend to prefer sitting at the front of the classroom to avoid visual obstructions (e.g. people’s heads). They may think in pictures and learn best from visual displays, including: diagrams, illustrated textbooks, overhead transparencies, videos, flipcharts and hand-outs. During a lecture or classroom discussion, visual learners often prefer to take detailed notes to absorb the information.
learning styles will help you to understand the ways children learn and to assist them in achieving educational success. (See section ‘Different learning styles’ on page 366 in Chapter 11.)

**Activity**

Think about a group of children that you work with. Are they visual, auditory or kinaesthetic learners? Think about how the children you work with gather and process information. Do they prefer to:

- work as an individual or in a group?
- follow step-by-step instructions or have open-ended projects?
- read and talk about work?
- engage in practical activities and experiment for themselves?

(For practical suggestions relating to the different learning styles, see the section ‘Supporting children during numeracy and literacy activities according to their learning styles’ in Chapter 13, on page 437.)

**Key term**

**Visual learners** – gather information through observation and reading, responding well to visual aids such as pictures, diagrams and charts.

**Auditory learners** – gather information by listening carefully and then repeating instructions either out loud or mentally in order to remember what they have learned.

**Kinaesthetic learners** – gather information through touch and movement, benefiting from physical interaction with their environment and plenty of emphasis on learning by doing.

The benefits of acknowledging learning needs of individuals to identify support

It is vital that all children have access to a stimulating learning environment that enables them to learn in exciting and challenging ways. Intellectual stimulation through appropriate learning activities allows children to develop their intellectual abilities and to fulfil their potential as individuals.

For learning to be as natural as possible, practitioners have to take different learning styles into account. While some children will learn well sat in a classroom, effectively learning by knowledge-based instructions, others need to have more of a ‘hands-on’ experience in either a real-life setting or in a simulation of some kind. There are also sociological elements that impact on learning styles. How a child interacts with others is fundamentally important to their success as a learner. Taking all this into account, it is clear that one way to combine the acquisition of skills and knowledge is through the effective use of play-based learning. Recognising play as a valuable learning tool within a learning environment has many advantages. Without even realising it, children can develop their imagination, extend their creativity and gain valuable communication skills. Learning new skills and knowledge through play is one of the most powerful ways for a child to gain and retain knowledge (Sinclair 2008).
It is important to engage learners by ensuring that science and technology activities have relevance for them. For some learners, relevant means the work should be ‘applied’ (e.g. the need to understand the chemistry of polymers as a basis for making new materials). For others, it is the need for some ‘personal link’, such as knowing someone with a heart defect as a stimulus to find out more about the structure and function of the heart. Discussion of ‘ethical issues’, hearing about a recent scientific discovery or learning about a person in science are other things that give science relevance for learners. Practitioners should also remember that for some learners, some things are relevant simply because they are found to be fascinating – there is a ‘wow’ factor. The key message here is that, if practitioners are to meet learners’ needs, we must build flexibility into the curriculum, otherwise we risk ending up with another ‘one-size-fits-all’ model (Bell 2008, p. 8).

Effective planning for young children involves:

- viewing children as powerful and competent learners
- using your knowledge of children as active learners to inform your planning
- observing children closely and respecting them as individuals in order to plan rich, meaningful experiences
- recognising that an experience must be holistic to be meaningful and potentially rich in learning
- planning a rich learning experience around the whole child, not around a specific area of learning
- taking a holistic approach to the planning process by recognising and building on the child’s needs, skills, interests and earlier experiences
- making your planning flexible: flow with the child.

(Abbott and Langston 2005)

**Activity**

In your own words, summarise the benefits of acknowledging the learning needs of individuals to identify support.

**Section 3: Be able to plan and deliver science and technology activities for children and/or young people**

As a practitioner, you should consider the individual needs, interests and stage of development of each child in your care. You should use this information to plan a challenging and enjoyable experience for each child, in all the areas of learning and development. When working with the youngest children, you should focus strongly on the three prime areas (personal, social and emotional development; physical development; and communication and language), which are the basis for successful learning in the other four specific areas (literacy; mathematics; understanding the world; and expressive arts and design). The three prime areas reflect the key skills and capacities all children need to develop and learn effectively. As children grow in confidence and ability within the three prime areas, the balance will shift towards a more equal focus on all areas of learning. Throughout the early years, if a child’s progress in any prime area gives you cause for concern, you must discuss this with the child’s parents and/or carers and agree how to support the child. You must consider whether a child may have a special educational need or disability which requires specialist support. You should link with, and help families to access, relevant services from other agencies as appropriate (DfE 2012, p. 6).

Effective planning for young children involves:

- viewing children as powerful and competent learners
- using your knowledge of children as active learners to inform your planning
- observing children closely and respecting them as individuals in order to plan rich, meaningful experiences
- recognising that an experience must be holistic to be meaningful and potentially rich in learning
- planning a rich learning experience around the whole child, not around a specific area of learning
- taking a holistic approach to the planning process by recognising and building on the child’s needs, skills, interests and earlier experiences
- making your planning flexible: flow with the child.

(Abbott and Langston 2005)

**Key term**

**Holistic** – looking at the ‘whole’ child or young person (i.e. all aspects of the child or young person’s development).
Planning science and technology activities for children and/or young people

Planning and implementing science and technology activities for children should be based on your observations and assessments of each child’s development and learning, your relationship with each child and your understanding of holistic development and learning. (More information about holistic development can be found in Chapter 5 ‘Understand child and young person development’ of Meggitt et al. 2011, pp. 49–66.)

Providing science and technology activities for children involves the following:

- **Planning**: defining aims and objectives, including planned and possible outcomes in play, building on previous outcomes from play.
- ** Organisation**: indoor and outdoor environments: space, resources, time, daily routines, activities, what adults do, what children do.
- ** Implementation**: the ways in which adult-initiated activities and tasks are presented in order to support intended and possible learning outcomes and build on previous learning experiences and interests. The ways in which adults allow time for, and follow, play and child-initiated activities.
- **Assessment, documentation and evaluation**: understanding patterns of learning, interests, dispositions. Identifying learning outcomes from adult- and child-initiated activities. Documenting learning in order to provide a feedback loop into planning. Using evidence from all adults in the setting to evaluate the quality and effectiveness of the curriculum.

(Wood and Attfield 2005, p. 139)

Identifying the aims of science and technology activities

Following your observation and assessment of a child’s development, learning and/or behaviour, your recommendations can provide the basis for planning appropriate activities to encourage and extend the child’s skills in specific areas, such as science and technology. Effective planning is based on children’s individual needs, abilities and interests, hence the importance of accurate and reliable child observations and assessments. Depending on the type of setting, you will also need to plan provision based on the requirements for the relevant curriculum frameworks for science and technology (see from page 1).

When planning science and technology activities, your overall aims should include:

- supporting the care and development of all the children you work with
- ensuring every child has full access to the appropriate curriculum
- meeting children’s individual developmental and learning needs
- building on each child’s existing knowledge, understanding and skills.

**Relating science and technology activities to other areas of learning**

When planning science and technology activities, it is essential to relate each activity to at least one other area of learning. For example, one of the overarching principles of the EYFS emphasises the interconnectivity between all areas of learning and development: ‘All areas of learning and development are important and are inter-connected’ (DfE 2011a, p. 4).

Learning in science and technology offers rich and exciting opportunities for interdisciplinary work across all areas of the curriculum. For example: the opportunities for collaboration with...
technologies afforded by the study of design in a variety of contexts; moving image media provides opportunities to explore science and design technology within art and design, and to combine these with traditional expressive arts in film-making work. Children and young people will develop, enhance and apply skills gained in science and technology in a very broad range of activities, including exploratory play, participation in whole-school events, community events and outdoor learning. Such activities promote the development of skills in areas such as talking and working with others, and contribute greatly to children and young people’s mental, emotional, social and physical well-being (Education Scotland 2012).

Helping children to develop their science and technology skills through play

Although play is a process rather than a subject, many play activities provide opportunities for learning through curriculum subject areas. These subject areas provide children with powerful tools for making sense of the world and incorporate distinctive, as well as interconnected, ways of learning (Wood and Attfield 2005, p. 122).

Practitioners need a good understanding of the structures of the subject areas of the curriculum – the concepts, skills, tools for enquiry and investigation, and ways of thinking and reasoning. They also need to understand the cross-curricular nature of teaching and learning, how connections can be made and what connections children make through their own activities. Although practitioners may prefer to view the curriculum as integrated from a perspective, they can plan and evaluate activities in terms of the subject areas (Wood and Attfield 2005, p. 137).

Implementing science and technology activities for children and/or young people

Good preparation and organisation are essential when implementing science and technology activities for children and/or young people. This may include: having any instructions and/or questions for the child or group of children ready (e.g. prompt cards, worksheet, work card or written on the board); ensuring there are sufficient materials and equipment, including any specialist equipment; setting out the materials and equipment on the table ready, or letting the children get the resources out for themselves, depending on their ages and abilities.

Implementing curriculum plans involves working with other people (e.g. parents, colleagues and other professionals) to deliver the appropriate curriculum for the children in your setting. You should implement planned curriculum activities and experiences that meet the needs of the children in your setting by:

- providing a stimulating, enjoyable and carefully planned learning environment, including using indoor and outdoor spaces
● using everyday routines to enhance learning
● ensuring a balance between structured and freely chosen play
● supporting and extending play to encourage learning by using your knowledge of individual children and their preferred learning styles
● using appropriate materials and support strategies for each child’s needs and abilities
● encouraging children’s participation and providing assistance at an appropriate level for each child, including supporting children with special needs
● having high expectations of children and commitment to raising their achievement based on a realistic appraisal of their capabilities and what they might achieve
● encouraging children to make choices about their own learning
● changing and adapting plans as required to meet the needs of all the children.

Your ability to provide effective support will depend on your experience of working with children and the specific science or technology activity. Ideally, you should be involved in the planning process so that you have a clear idea of the teaching and learning objectives for the learning activity involving science and/or technology. Making a note of key questions will enable you to understand the expected outcomes for learners. Appropriate feedback at the end of a lesson can help to inform future provision.

During activities, encourage children (as appropriate to their age and level of development) to:
● think about the activities (e.g. why they are doing them and what they are going to learn, practise or create)
● plan their own work or to speculate on ‘what might happen if...’
● reflect on what they know, understand and can do
● share successes and discuss any difficulties encountered.

When supporting children during science and technology activities, you need to take into account:
● your competence and confidence with materials, tools and equipment
● the age, ability and expertise of children – for example, you may need to provide more support for younger children or some children with special needs; older children may be very confident users of technology
● the complexity of the activity and/or your familiarity with the appropriate hardware and software.

In addition, remember to maintain the children’s safety at all times.

Maintaining children’s safety during science and technology activities

All practitioners are responsible for the health and safety arrangements of the children (and others) under their supervision and should take all reasonable steps to:
● exercise effective supervision over those for whom they are responsible, including children, students and volunteer helpers
● be aware of and implement safe working practices and to set a good example
● identify actual and potential hazards and implement procedures to minimise the possibility of mishap
● ensure that any equipment or tools used are appropriate to that use and meet approved safety standards
● provide written instructions, warning notices and signs as appropriate
● provide appropriate protective clothing and safety equipment as necessary and ensure that these are used as required (e.g. safety goggles)
● investigate any accident (or incident where personal injury could have arisen) and take appropriate corrective action
● provide for adequate instruction, information and training in safe-working methods, and recommend suitable safety training where appropriate
● refer considerations for corrective action that is outside the scope of their authority to the delegated person
● refer any concerns about health and safety to the delegated person.

(Detailed information about maintaining children’s safety can be found in Chapter 8 ‘Support children and young people’s health and safety’ in Meggitt et al. 2011, pp. 142–156.)
Evaluating the science and technology activities implemented in relation to children’s learning

After you have planned and implemented the science or technology activity, you will need to evaluate it. Some evaluation also occurs during the routine or activity, providing continuous assessment of a child’s performance. It is important to evaluate each activity so that you can:

- assess whether the activity has been successful (e.g. have the aims and objectives or outcomes been met?)
- identify possible ways in which the activity might be modified/adapted to meet the individual needs of the child or children
- provide accurate information for the senior practitioner, setting manager or other professionals about the successfulness of a particular routine or activity.

The senior practitioner, setting manager or your college tutor/assessor should give you guidelines on how to present your activity plans. If not, you could use the suggested format on page 43 in Chapter 1.

In Practice

1. Plan a science activity for children and/or young people that will include: the aim of the activity; recognition of individual needs; how the activity relates to one other area of learning. (As the starting point for this activity, you could use your observation of a child involved in a science activity on page 20, plus your suggestions to support children’s scientific skills on page 21.)

2. Implement the science activity planned for children and/or young people.

3. Analyse the outcome of the activity implemented in relation to the children and/or young people’s learning.

4. Evaluate the outcome of the activity implemented in relation to the aim and the one other area of learning identified.

In Practice

1. Plan a technology activity for children and/or young people that will include: the aim of the activity; recognition of individual needs; how the activity relates to one other area of learning. (As the starting point for this activity, you could use your observation of a child involved in a design and technology activity on page 26 and/or a child engaged in an ICT activity on page 23, plus your suggestions to support children’s design and technology skills on page 27 and ICT skills on page 25.)

2. Implement the technology activity planned for children and/or young people.

3. Analyse the outcome of the activity implemented in relation to the children and/or young people’s learning.

4. Evaluate the outcome of the activity implemented in relation to the aim and the one other area of learning identified.

Figure 14.11 A boy enjoying a science activity (© Andrew Callaghan)
Section 4: Be able to reflect on own practice

Effective practice requires committed, enthusiastic and reflective practitioners with a breadth and depth of knowledge, skills and understanding. To be an effective, reflective practitioner, you should use your own learning to improve your work with children and their families in ways which are sensitive, positive and non-judgemental.

Through initial and on-going training and development, you can develop, demonstrate and continuously improve your:

- own science and technology skills as necessary
- relationships with children and their families to encourage the development of science and technology skills outside the setting (e.g. cooking activities, model-making, visiting museums)
- understanding of the individual and diverse ways that children develop and learn
- knowledge and understanding in order to actively support and extend children’s learning in science and technology, as well as across all areas and aspects of learning
- practice in meeting all children’s needs, learning styles and interests
- work with parents, carers and the wider community to develop children’s science and technology skills in meaningful contexts (e.g. visits to science and technology museums, nature and wildlife reserves)
- work with other professionals.

(DfES 2005)

Reflecting on the planning process for each science and technology activity

As a practitioner, you need to know and understand the techniques of reflective analysis: questioning what, why and how; seeking alternatives; keeping an open mind; viewing from different perspectives; thinking about consequences; testing ideas through comparing and contrasting; asking ‘what if?’; synthesising ideas; seeking, identifying and resolving problems (NDNA 2004).

Self-evaluation is needed to improve your own professional practice and to develop your ability to reflect upon activities and modify plans to meet the individual needs of the children and/or young people you work with. When evaluating your own practice you should consider the following:

- Was your own particular contribution appropriate?
- Did you choose the right time, place and resources?
- Did you intervene enough or too much?
- Did you achieve your goals (e.g. objectives/outcomes for the child/children and yourself)? If not, why not? Were the goals too ambitious or unrealistic?
- What other strategies/methods could have been used? Suggest possible modifications.
- Who should you ask for further advice (e.g. senior practitioner, setting manager, other professional)?

Reflecting on own practice in supporting the delivery and outcome of the activities

You need to know and understand clearly the exact role and responsibilities in supporting the delivery and outcome of science and technology activities. Review your professional practice by making regular and realistic assessments of how well your working practices match your role and responsibilities. Share your self-assessments with those responsible for managing and reviewing your work performance (e.g. during your regular discussions/meetings with your colleagues or with your line manager). You should also ask other people for feedback about how well you fulfil the requirements and expectations of your role. You can also reflect on your own professional practice.
by making comparisons with appropriate models of good practice (e.g. the work of more experienced practitioners within the setting).

Drawing conclusions which show how to extend and refine future practice

From the individual’s point of view, there is a responsibility for keeping up-to-date, developing new skills and maintaining the highest possible professional standards in everything they do. This includes thinking ahead to possible future developments and preparing for them in appropriate ways (Bell 2008, p. 10).

You should work together with your colleagues and other professionals to create a learning community that includes science and technology specialists (e.g. scientists, technicians, ICT practitioners, designers, architects and urban planners), parents, families, carers, teachers and educational consultants. You should assist parents and carers in understanding the importance of helping children to develop the science and technology skills they need for learning and everyday life.

You can extend and refine future practice by:
- knowing and understanding the relevant curriculum within the setting
- planning science and technology activities that reinforce learning within the appropriate curriculum, both in the setting and in the home (including cultural events and customs)
- being familiar with children’s levels of development
- recognising that play is a critically important vehicle in supporting the development of children’s science and technology skills
- facilitating developmentally-appropriate child-initiated and child-centred activities to develop young children’s science and technology skills
- using a child’s language in as many experiences as possible (e.g. labelling objects)
- recognising the child’s efforts and works (e.g. displaying work and giving positive feedback), and having a place for all children’s efforts, not just the ‘best’
- recording and communicating each child’s progress and achievements in science and technology
- being a good listener and observer and encouraging others to be the same
- communicating regularly with parents, colleagues and other practitioners about science and technology activities
- participating in inter-generational programmes which connect young children, older children, young people and older members of the community (such as grandparents).

(Adapted from Goldhawk 1998, p. 5)

Activity

1. Give examples of how you reflect on the planning process, delivery and outcome of science and technology activities, including: self-evaluation; reflections on your interactions with others; sharing your reflections with others; using feedback from others to improve your own evaluation.

2. Describe how you have used reflection to extend and refine future practice.
Useful resources

Organisations and websites

**British Association for Early Childhood Education**
Early Education (2012) *Development Matters in the Early Years Foundation Stage (EYFS)*
http://media.education.gov.uk/assets/files/pdf/d/development%20matters%20in%20the%20eyfs.pdf

**Early Years Experience**
This website provides ideas, resources and information for practitioners, parents and carers of preschool, nursery and Key Stage 1 children (5–7 years of age). Includes useful sections on science activities, growing things, cooking ideas and recipes, and craft ideas.
www.bigeyedowl.co.uk/index.htm

**Foundation Years**
This website (developed by 4Children) is the ‘one-stop-shop’ for resources, information and the latest news on the foundation years. The website provides advice and guidance for practitioners on working effectively with parents as partners in their children’s learning.
www.foundationyears.org.uk

**Homerton Children’s Centre**
This website (produced by Harriet Price with Homerton Children’s Centre) has a resources section that includes training materials, recommendations for software and hardware, planned ICT experiences and examples of uses of ICT. Each ICT resource is supported by ideas and information, PowerPoint presentations and short video extracts.
http://ictearlyyears.e2bn.org/index.php

**Siren Films**
Siren Films produces high-quality DVDs covering a wide range of topics, such as the first year of life, two-year-olds, three- and four-year-olds, learning through play, exploratory play, pretend play, outdoor play, and learning and development.
www.sirenfilms.co.uk

**Teaching Ideas**
This website provides free ideas, resources, information and advice for teaching and learning, including science, ICT, and design and technology.
www.teachingideas.co.uk

Books and articles

Useful resources (cont.)

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<tr>
<th>Author</th>
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Useful resources (cont.)


