Subject Area Syllabus and Guidelines

Agricultural Education

Level 4 to Beyond Level 6

Queensland Studies Authority

Partnership and innovation

ISBN: 1 920749 09 8
Agricultural Education Subject Area Syllabus and Guidelines

Level 4 to Beyond Level 6

The main cover picture shows students of Beenleigh State High School. The picture of the tractor is also from Beenleigh SHS. Other pictures are by courtesy of the Queensland Department of Primary Industries.

Queensland Studies Authority, PO Box 307, Spring Hill, Queensland 4004, Australia
Phone: (07) 3864 0299
Fax: (07) 3221 2553
Email: office@qsa.qld.edu.au
Website: www.qsa.qld.edu.au

Contents

Introduction

Subject area syllabuses have been developed to cater for specialised student interests within the framework of a core and common curriculum in Queensland.

The common curriculum and the subject areas

The role of the common curriculum for Queensland schools is to provide a comprehensive education for all students during the compulsory years of schooling. It consists of the eight nationally agreed key learning areas:

- The Arts
- English
- Health and Physical Education (HPE)
- Languages other than English (LOTE)
- Mathematics
- Science
- Studies of Society and Environment (SOSE)
- Technology.

The Queensland curriculum for the compulsory years of schooling is based on an outcomes approach.

The core of the Queensland curriculum for the compulsory years of schooling consists of a selection of essential learnings expressed as 'core learning outcomes'. 'Discretionary learning outcomes' describe what students know and can do beyond what is essential at a particular level.

Key learning area syllabuses describe core learning outcomes in developmental levels along learning continua for the 10 years of compulsory schooling. The common curriculum is conceptualised as a whole, rather than segmented into sections for different phases of schooling.

During the later years of compulsory schooling, many schools may offer their students subjects that allow them to engage in specialised studies in specific contexts. Syllabuses have been developed for five subject areas that are typically a focus of curriculum choice and specialisation. These are:

- Agricultural Education
- Business Education
- Home Economics Education
- Industrial Technology and Design Education
- Information and Communication Technology Education.

Through the experiences, challenges and opportunities associated with each subject area, students develop a unique range of knowledge, practices and dispositions. These can be

described through learning outcomes that are specific to the subject area. In certain contexts, some learning outcomes from different key learning areas contribute to a subject area.

Subject area syllabuses and guidelines

Syllabuses and guidelines have been developed for five subject areas. Typically, schools will use the subject area syllabuses to plan a variety of courses of study that will provide particular students with specialised learning experiences in specific contexts.

Subject area strands are contextual. The strands are used to organise the learning outcomes in the syllabus. The strands contain two types of learning outcomes — 'central learning outcomes' and 'supplementary learning outcomes'. The central learning outcomes describe the learnings that are considered fundamental to the subject area. It is recommended that these be the primary focus of a course of study developed for a subject area. Central learning outcomes consist of subject-area-specific learning outcomes and some core learning outcomes from different key learning areas. Supplementary learning outcomes are additional learning outcomes that could be considered for inclusion to enrich a course of study.

Central and supplementary learning outcomes have codes that identify the strand and developmental level to which they belong (see Outcomes section). If these learning outcomes have been selected from a key learning area syllabus, the key learning area code for that learning outcome is indicated in parentheses.

Subject area syllabuses describe learning outcomes from Level 4 to Beyond Level 6. Subject area syllabuses are not specifically associated with particular year levels of schooling; however, it is predicted that they will be used for planning courses of study in middle schools and lower secondary schools. These subject area syllabuses may also be used in other educational settings where there are specific student interests in the subject area, appropriate school resources and teacher expertise.

Subject area syllabuses cannot be regarded as alternatives to each other or to particular key learning areas. Each subject area syllabus contains different subsets of learning outcomes from different key learning areas, as well as learning outcomes that are specific to particular subject areas.

Courses of study

Courses of study are planned sets of learning experiences and assessment tasks that have a specified duration and location in a school's overall curriculum offering. They may be units offered within a vertical timetable, a semester, a single year or multiple years. Courses of study may be developed from any of the subject area and/or key learning area syllabuses.

The time allocation for courses of study based on subject area syllabuses is a school-based decision.

Subject area syllabuses enable schools to plan courses of study that meet a variety of student needs and interests.

When planning courses of study, the following should be considered:

- the needs of students
- resources and staff
- the place and role of courses of study within the total school curriculum.

Further information is available in the Guidelines section.

Rationale

Nature of the subject area

For thousands of years, people all over the world have practised agriculture — producing, processing, marketing and distributing food, fibre and animal derivatives for their needs and wants. Agricultural practices have helped form individual and national identities and values, and local and global cultures and economies.

Modern agricultural practices make use of scientific, technological, ecological, social and economic knowledge to meet the needs and wants of consumers. Today's agricultural practices are designed to achieve greater production yields, contribute to the conservation of the environment and community health, and reflect a commitment to animal welfare. People involved in agricultural production today strive to use non-renewable resources efficiently and to increase their use of renewable resources.

Agricultural Education focuses on agricultural systems, agricultural mechanics and construction, and the relationships between agriculture and society. It provides opportunities for students to explore the relationships between agricultural production and sustainability within contexts ranging from local area enterprises to global agricultural systems.

Students develop understandings of how science is applied to production. They become familiar with the agricultural service industries and the development of land and agricultural enterprises for recreational use. They investigate the role of culture, finance and politics on production and decision making. Students understand that in this subject area, knowledge, concepts and applications are continually changing and that there are many opportunities for critical and creative thinking.

Nature of learning in the subject area

Agricultural Education provides opportunities for students to contribute to society as active and informed citizens. It provides opportunities for all students, including those with a general interest in agriculture and those intent on pursuing careers directly involved in agriculture or agribusiness. Such students may become veterinarians, mechanics, soil scientists, plant or animal geneticists, or market managers.

Agricultural Education embraces theoretical understandings and practical applications in a range of agricultural activities.

In Agricultural Education, students use agricultural practice to design, plan, implement and evaluate agricultural enterprises, activities and equipment. Agricultural practice involves aspects of 'working scientifically' and 'working technologically'.

Courses of study in Agricultural Education include learning activities related to enterprises such as grain, beef and dairy production. Increasingly, these courses of study include new and emerging industries such as hydroponics, goat meat production, aquaculture, vermiculture, and amenities horticulture — for example, municipal parks and gardens.

Through participating in agricultural enterprises that closely approximate real-life situations, students develop understandings about the nature of work and the safety issues associated with agriculture. These enterprises provide relevant learning contexts for students to develop knowledge, practices and dispositions that are transferable to other agricultural and life contexts. They also provide opportunities to encourage the spirit of entrepreneurship in profit and non-profit activities.

The Agricultural Education subject area provides the context for students to develop a unique repertoire of knowledge, practices and dispositions. Students also have opportunities to develop some knowledge, practices and dispositions from the key learning areas of Science, Technology, Studies of Society and Environment, and Health and Physical Education in agricultural contexts.

Contribution of the subject area to lifelong learning

The Queensland school curriculum is designed to assist students to become lifelong learners. The overall learning outcomes of the curriculum contain elements common to all key learning areas and subject areas, and collectively describe the valued attributes of a lifelong learner.

A lifelong learner is:

- a knowledgeable person with deep understanding
- a complex thinker
- an active investigator
- a responsive creator
- an effective communicator
- a participant in an interdependent world
- a reflective and self-directed learner.

The Agricultural Education subject area provides many opportunities for students to develop the valued attributes of lifelong learners.

Knowledgeable person with deep understanding

Learners understand that the knowledge and practices of agriculture are used to meet the needs of people and societies. They understand that agriculture is an endeavour that affects the whole population and includes a variety of agricultural enterprises and related industries. Learners understand agricultural plant and animal systems, agricultural mechanics and construction, and the relationships between society and agriculture.

Complex thinker

Learners design, plan, implement and evaluate agricultural activities and investigations. They gather information on the options and variables that impinge on agricultural enterprises. Learners think deductively and make decisions about how activities should progress. They critically analyse and synthesise information and make judgments about the relevance of data.

Active investigator

Learners monitor and assess aspects of agricultural activities in order to maintain and improve quality and productivity. They collect and collate information and use a range of technologies to enhance their investigations and improve their efficiency in proposing new management practices. Learners investigate regulations and market forces that impinge directly on agriculture and associated industries.

Responsive creator

Learners imagine and create a range of possible solutions to agricultural challenges, particularly when resources are limited. They consider and explore the consequences of a range of options before offering possible solutions. Learners generate new ways of undertaking agricultural activities that demonstrate their ingenuity and enterprise, and ethical, social and environmental responsibility.

Effective communicator

Learners gather and comprehend information from many sources in order to develop greater understandings of new methods and technologies. They critically explore and discuss new ideas, and communicate clearly with a range of audiences. Learners communicate using appropriate genre and agricultural terminology. They use information and communication technologies to enhance communications where appropriate.

Participant in an interdependent world

Learners understand that every agricultural enterprise should be assessed for its impact on individuals, communities, and local and global environments. They observe, assess and make judgments about different perspectives and consider the concerns of all stakeholders. Learners demonstrate their responsibility for stewardship of the environment.

Reflective and self-directed learner

Learners reflect on, evaluate and re-examine their conclusions in the process of planning agricultural activities. They seek opportunities to use their agricultural knowledge, practices and dispositions in new situations. Learners evaluate their own and others' assumptions and opinions and are able to make fair judgments about implications for themselves, others, future agricultural activities and the environment.

Cross-curricular priorities

The Agricultural Education subject area incorporates and promotes the cross-curricular priorities of literacy, numeracy, lifeskills and a futures perspective.

Literacy

Literacy is a social practice that uses language for thinking and making meaning in cultures. It includes reading and writing, speaking and listening, viewing and shaping, often in combination in multimodal texts within a range of contexts. Critical thinking is also involved in these practices. Students seek and critically appraise information, make choices and use their literacy skills to become independent learners. They develop critical literacy by questioning the cultural and social practices embedded in various kinds of texts. Students learn about relationships between the contexts and audiences of those texts. They understand that literacy influences how people view themselves, their identities and their environments as well as providing ways to represent these views.

Students read, write, speak, listen to, view and exchange information about agriculture. They use a range of genres, including written, visual and oral, in critically evaluating agricultural issues, developing plans, procedures, implementation strategies and reports. They use electronic, print and other media to gain access to Australian and international agricultural information.

Numeracy

Numeracy is the demonstration of practices and dispositions that accurately, efficiently and appropriately meet the demands of typical everyday situations involving number, space, measurement and data.

Students develop numeracy as they plan, implement and evaluate agricultural activities. They estimate costs, develop budgets and assess enterprises from an economic perspective. Students may also calculate feed to weight-gain ratios and keep records for breeding, production, income and expenditure. They may develop and demonstrate numeracy in agricultural construction when developing plans to convey proposed constructions or when reading and interpreting plans to create agricultural equipment, structures and products.

Lifeskills

Lifeskills is a term used to describe the knowledge, practices and dispositions considered necessary for people to function adequately in their current and changing life roles and situations. Demonstration of lifeskills takes place in two overlapping dimensions: practical performance of, and critical reflection on, those skills.

It is possible to identify at least four sets of lifeskills that enable students to participate in four life roles. The lifeskills, and related life roles, are:

- personal development skills — growing and developing as an individual
- social skills — living with and relating to other people
- self-management skills — managing resources
- citizenship skills — receiving from and contributing to local, state, national and global communities.

Courses of study in Agricultural Education contribute to the development of lifeskills by providing students with opportunities to develop:

- as individuals by taking responsibility for their own actions, forming their own opinions and building self-respect and self-esteem
- social and interpersonal skills by taking part in group activities, listening to the points of view of others, consulting and negotiating with others and contributing to group decisions
- self-management and resource management skills by accepting individual responsibility for specific aspects of agricultural activities
- citizenship skills through active participation, discussion and consideration of their ethical, social and environmental responsibility to produce safe and healthy products.

Futures perspective

A futures perspective involves knowledge, practices and dispositions that enable students to identify individual and shared futures. A futures perspective leads to insights and understandings about thinking ahead, and the roles of individuals and groups in envisioning and enacting preferred futures.

Students with insights and knowledge about the past and present consider the consequences of past and future actions. They take responsibility for their actions and decisions and are empowered to participate optimistically in processes of social innovation, recovery and renewal.

Students consider the current expectations people have with regard to agricultural products, including consumer expectations related to chemical contamination or genetic modification. Students debate issues impacting on agricultural production such as animal welfare and cloning. They explore social and ethical issues, such as biotechnology, from local and global perspectives. Students consider present practices and propose possible, probable and preferred futures for agriculture.

Other curricular considerations

The Agricultural Education subject area also incorporates work education.

Work education

Work involves both the paid employment that people undertake and the unpaid work they perform within the groups, communities and societies to which they belong. It occurs with different types and groupings of people in different settings and is performed under many different conditions.

Work education involves **learning for work**, **learning about work** and **understanding the nature of work**:

- Learning for work involves developing work-related knowledge, practices and dispositions.
- Learning about work emphasises student understandings about work and the settings and conditions that characterise workplaces. It highlights the benefits of work to individuals and communities.
- Understanding the nature of work involves critically reflecting on and analysing the sociocultural, economic and political forces that influence the ways society values different kinds of work.

While work education includes providing opportunities for students to explore options for future education, training and paid employment, this is not its sole purpose; nor is it intended to focus exclusively on the development of vocationally oriented skills. Work education has a much broader role — that of preparing students for work in all the forms and contexts in which it occurs. This includes preparing students to participate effectively in paid and unpaid work, to understand the issues involved in balancing these different kinds of work (including family responsibilities), and to recognise the benefits to society of assisting workers to achieve this balance.

Students learn for work by participating in a variety of agricultural enterprises, and planning and managing agricultural activities. They have opportunities to develop positive behaviours and dispositions to participate fairly, appropriately and effectively in work settings. Students are given personal responsibility for different tasks within a range of school enterprises that require dispositions of care and reliability. For example, they may be required to meet obligations, use time productively, work cooperatively with others, and display initiative and commitment.

In Agricultural Education, students learn about work and work opportunities through the study of, and participation in, school and local agricultural enterprises. These contexts provide opportunities for students to understand and experience the types of work available

in agriculture and related fields. Students understand workplace practices and regulations needed to create safe and equitable workplaces.

Students understand the impact of changes such as technological developments, globalisation and division of labour on the nature of agricultural work. They develop understandings about the contribution and value of different types of work to the agricultural industry within local, national and global communities. Students understand the role of paid, unpaid and voluntary work in shaping and promoting local and Australian agriculture. They understand the types of work forces required for the agricultural industry.

Understandings about learners and learning

The following assumptions about learners and learning underpin the Agricultural Education subject area.

Learners

- Learners are unique individuals and thinkers with divergent views about the world.
- Learners have a broad range of knowledge, attitudes, values and experiences shaped by their gender, socioeconomic status and geographical location, and by other aspects of their background, all of which form part of their learning environment. Their prior knowledge and experiences influence the meaning they make of any new learning experience.
- Learners grow, develop and learn in different ways, in different settings and at different rates. By engaging in learning activities that match their needs, interests, understandings and individual learning styles, learners have opportunities to develop and extend their capabilities.

Learning

- Learning is a lifelong process.
- Learning occurs within and across cultural contexts and social situations and is influenced by them.
- Learning is most effective when the learning environment is safe, supportive, enjoyable, collaborative, challenging and empowering.
- Learning is most effective when it involves active partnerships with students, parents/ carers, peers, teachers, and school and community members.
- Learning contexts should acknowledge equity principles by being inclusive and supportive and by acknowledging and valuing diversity.
- Learning is enhanced and supported when teaching approaches are culturally sensitive.
- Learner-centred strategies are most effective in enabling learners to make informed choices and to take actions that support their own and others' wellbeing.
- Learning requires active construction of meaning and is effective when it is developed in meaningful contexts and accommodates, acknowledges and builds on prior knowledge.
- Learning is enhanced when learners have opportunities to reflect on their own thinking and learning.
- Learning is enhanced by the use of a range of technologies.

Learner-centred approach

A learner-centred approach to learning and teaching views learning as the active construction of meaning, and teaching as the act of guiding and facilitating learning. This approach considers knowledge as being ever-changing and built on prior experience.

A learner-centred approach provides opportunities for students to practise critical and creative thinking, problem solving and decision making. This involves recall, application, analysis, synthesis, prediction and evaluation, all of which contribute to the development and enhancement of conceptual understandings. A learner-centred approach also encourages students to reflect on and monitor their thinking as they make decisions and take action.

Agricultural Education encourages students to contribute to group decisions and actions related to designing, planning, implementing and evaluating agricultural activities. Students are encouraged to take responsibility in practical agricultural activities and learn through reflection on and evaluation of the outcomes.

Equity in the curriculum

The Queensland school curriculum is designed to challenge inequities by:

- acknowledging and minimising unequal outcomes of schooling for different groups of students
- identifying and minimising barriers to access, participation, active engagement, construction of knowledge and demonstrations of learning
- using the knowledge, practices and dispositions of all students as a basis for their learning and for enhancing the learning of others in the community
- developing understanding of, and respect for, diversity within and among groups
- making explicit the fact that knowledge is historically, socially and culturally constructed
- making explicit the relationship between valued knowledge and power relations
- identifying and promoting the capacity of the Agricultural Education subject area to develop knowledge, practices and dispositions that empower students to challenge injustices and inequities.

The curriculum also provides opportunities for students to learn about equity and equity issues in the context of the subject area.

Student access and participation

In an inclusive curriculum, consideration is given to the interrelationships between culture, language, ability, gender, sexual identity, location and socioeconomic circumstance, and their impact on students' perspectives and experiences, and therefore access to, and success in, the curriculum.

Students bring varied prior experiences to the classroom, some of which support their learning in Agricultural Education, and others that may make this more difficult. Students' diverse experiences and their resultant perspectives of agriculture need to be considered when planning.

The selection of concepts, contexts, contents and learning experiences needs to accommodate the diverse learning styles, interests and experiences of students if learning is to be maximised.

Learning about equity

Students explore, express and challenge personal, group and societal values that reinforce and perpetuate inequities.

Through the learning activities in Agricultural Education, students understand and appreciate diverse needs and perspectives, and learn to value and respect people, cultures and their environments. Students develop knowledge, practices and dispositions to critique social and political structures and power relations created through agricultural activities that have the potential to work for or against individuals or groups.

Students develop understandings about the historical, societal, cultural, spiritual, political and economic constructions of and contexts in which agricultural products and practices are created and valued, and the dynamic interrelationships that exist between these. This promotes understanding of the heterogeneity of practices, beliefs and values within and across cultural groups. This, in turn, empowers students to become lifelong learners and active and critical participants in interdependent societies.

Outcomes

Framework

This syllabus provides a framework for planning learning activities and assessment opportunities through which students demonstrate what they know, and can do with what they know, in the Agricultural Education subject area.

Subject area outcomes

The subject area outcomes highlight the uniqueness of the Agricultural Education subject area and its particular contribution to lifelong learning. In this subject area, students develop the knowledge, practices and dispositions necessary to:

- investigate the interactive nature and extent of agriculture and agricultural endeavours
- respond to agricultural challenges and solve agricultural problems using agricultural practice (which includes 'working technologically' and 'working scientifically')
- investigate the cultural, economic and environmental importance of agriculture in local, national and global systems
- value the role of agriculture within society and its contribution to our past, present and future
- reflect on society's views about agriculture and the environment
- reflect on and evaluate current and emerging technologies available to agriculture in terms of their advantages and their efficacy
- evaluate agricultural products, processes and outputs in terms of quantity, quality, safety and public acceptance
- develop a commitment to sustainability and conservation of the environment while undertaking agricultural endeavours.

Strands of the subject area

The learning outcomes of the Agricultural Education subject area are organised into three strands:

- Agricultural Systems
- Agriculture and Society
- Agricultural Mechanics and Construction.

Students develop their understandings of the concepts within the strands throughout the later years of compulsory schooling. Courses of study can be planned using learning outcomes from a single strand or from a number of strands.

Agricultural Systems

This strand focuses on understandings of the relationships between agricultural systems and ecological, economic and political systems in different areas of the world. Understandings of plant and animal science and husbandry practices required for the care of plants and animals are developed and applied to agricultural enterprises. The organisers for this strand are:

- agriculture — a local and global perspective
- agricultural plant and animal characteristics
- agricultural plant and animal science
- plant and animal husbandry practices
- technology practice — agricultural systems.

Agriculture and Society

This strand focuses on the relationships between agriculture and society. It emphasises understandings about how agriculture in the past contributes to present-day agriculture and its possible, probable and preferred futures. Students explore the interactions between agriculture, science, technology and the environment. They reflect on people's views of agriculture and make predictions about the future contribution of agriculture to society. It emphasises agriculture's contribution to local and Australian economies.

The organisers for this strand are:

- agriculture — past, present and future
- agriculture, science and technology
- agriculture and the environment
- agriculture and the economy.

Agricultural Mechanics and Construction

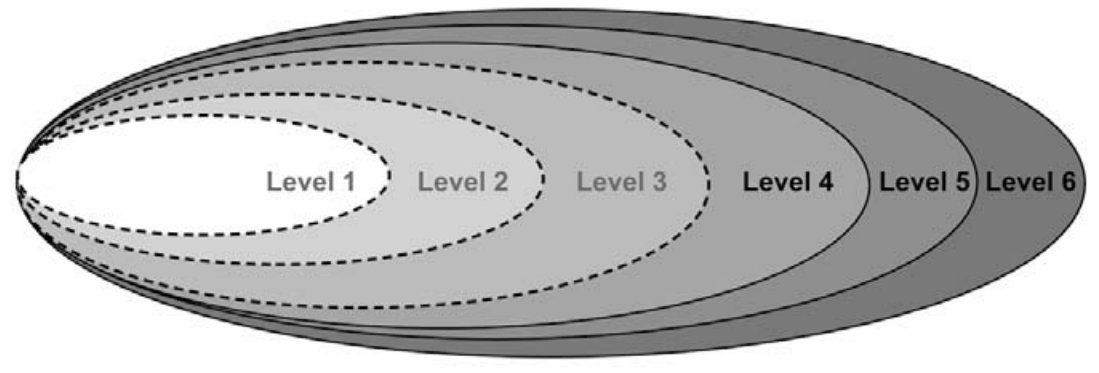
This strand focuses on the practical nature of agricultural mechanics and construction. It emphasises understandings and applications of engine and machine operation and construction to a range of agricultural equipment and activities. Understandings of safe practices and behaviours and their importance to all agricultural activities are emphasised. The organisers for this strand are:

- agricultural mechanics
- agricultural construction — nature of materials
- agricultural construction — techniques with materials
- agricultural safety
- technology practice — mechanics and construction.

Levels

The levels outlined on the following pages indicate progressions of increasing sophistication and complexity in learning outcomes. This syllabus describes learning outcomes for Level 4, Level 5, Level 6 and Beyond Level 6. The sequencing of the learning outcomes is such that each level is 'nested' within the following level. Learning outcomes for successive levels are conceptually related to each other, forming a continuum rather than existing simply as a number of discrete entities.

A level statement is included for each level of each strand of the syllabus. The level statement summarises learning outcomes at each level and provides a framework for developing the central and supplementary learning outcomes.



Progression of conceptual development of outcomes

Central learning outcomes

Central learning outcomes describe those learnings that are considered fundamental to a course of study based on a subject area syllabus. They describe what students know, and can do with what they know, as a result of planned learning activities. The central learning outcomes are presented in order of increasing complexity from Level 4 to Beyond Level 6. Students should be provided with multiple opportunities to demonstrate those learning outcomes selected for inclusion in a course of study. A course of study may include only some of the learning outcomes described in this syllabus.

Central learning outcomes may be of two types:

- subject-area-specific learning outcomes — these are specific to the subject area and are not described in the core learning outcomes of the key learning areas
- core learning outcomes — these are selected from antecedent key learning areas, in a subject area context, and are fundamental to the subject area. Core learning outcomes are included from the key learning areas of Science, Technology, Studies of Society and Environment, and Health and Physical Education. These learning outcomes are labelled to indicate their key learning area code and strand codes. For example, a core learning outcome from the *Years 1 to 10 Technology Syllabus* and Technology Practice strand will be coded as Tech TP.

Supplementary learning outcomes

Supplementary learning outcomes describe what students know, and can do with what they know, beyond what is considered fundamental at a particular level. They indicate additional learnings considered desirable. The supplementary learning outcomes are included to assist teachers in broadening the understandings of those students who have already demonstrated central learning outcomes. Additional supplementary learning outcomes could be developed by schools or teachers. At Beyond Level 6 all learning outcomes are supplementary.

Relationship of outcome levels to year levels

For the purposes of planning learning activities and assessment opportunities, outcome levels typically relate to years of schooling as follows:

- students demonstrating Level 4 outcomes are at the end of Year 7
- students demonstrating Level 6 outcomes are at the end of Year 10.

Some students will demonstrate learning beyond the typical levels described above. Other students will require more time to demonstrate their learning.

[This page has been left blank intentionally.]

*L*earning outcomes

Agricultural Systems

Organisers for the learning outcomes in the Agricultural Systems strand are:

- agriculture — a local and global perspective
- agricultural plant and animal characteristics
- agricultural plant and animal science
- plant and animal husbandry practices
- technology practice — agricultural systems.

Level 4	Level 5
Level statement	**Level statement**
Students understand how Australian agricultural industries link to global systems. They understand the anatomy of some plants and animals and the ways different living things reproduce. They explain the relationship between husbandry practices and the growth of selected plants and/or animals. They use technology practice to participate in agricultural enterprises.	*Students understand the relationships between ecological, government and economic systems that relate to agriculture. They understand the physiology of plants and animals, and the processes of reproduction and growth of selected plants and/or animals. They demonstrate husbandry practices, participate as team members and use technology practice in agricultural enterprises.*
Central learning outcomes	**Central learning outcomes**
AS 4.1 Students outline how Australian industries link to global economic and ecological systems. (SOSE SRP 4.1)	**AS 5.1** Students evaluate the relationship between an ecological system and a government and/or an economic system. (SOSE SRP 5.1)
AS 4.2 Students identify the anatomical features of some plants and animals in relation to their usefulness as agricultural products.	**AS 5.2** Students explain some features of the physiology of plants and animals and relate these to the growth of these plants and animals.
AS 4.3 Students identify and analyse similarities and differences in the ways that different living things reproduce. (Sc LL 4.2)	**AS 5.3** Students evaluate different processes and strategies of reproduction (including asexual reproduction and care of young) in terms of their relative efficiency in ensuring survival of offspring. (Sc LL 5.2)
AS 4.4 Students participate in selected plant and/or animal enterprises and explain how husbandry practices provide for optimal growth.	**AS 5.4** Students participate as team members and demonstrate husbandry practices for selected plant and/or animal enterprises.
AS 4.5 Students use technology practice (as described in the Level 4 core learning outcomes in the *Years 1 to 10 Technology Syllabus*) to promote effective agricultural production (see appendix 1).	**AS 5.5** Students use technology practice (as described in the Level 5 core learning outcomes in the *Years 1 to 10 Technology Syllabus*) to promote effective agricultural production (see appendix 1).
Supplementary learning outcome	**Supplementary learning outcome**
AS 4.6 Students investigate how a local agricultural enterprise uses planning, production and evaluation sequences in their operations.	**AS 5.6** Students compare and evaluate different production systems used for similar enterprises.

Key:

- Sc — in *Years 1 to 10 Science Syllabus*; Strand: LL — Life and Living.
- SOSE — in *Years 1 to 10 Studies of Society and Environment Syllabus*; Strand: SRP — Systems, Resources and Power.

*L*earning outcomes

Agricultural Systems

Organisers for the learning outcomes in the Agricultural Systems strand are:

- agriculture — a local and global perspective
- agricultural plant and animal characteristics
- agricultural plant and animal science
- plant and animal husbandry practices
- technology practice — agricultural systems.

Level 6	Beyond Level 6
Level statement *Students understand the relationships between agriculture and global economic and ecological systems. They understand reproductive methods and use scientific ideas to explain variations in agricultural plant and animal species. They participate in the management of agricultural enterprises and evaluate husbandry practices used. They use technology practice in agricultural enterprises.*	**Level statement** *Students predict the impact of different economic, political or ecological systems on agriculture. They predict the variations of plant and animal breeding programs and the impact of the manipulation of reproductive processes and genetic inheritance. Students develop and use management and husbandry practices and technology practice in agricultural enterprises.*
Central learning outcomes	**Supplementary learning outcomes**
AS 6.1 Students develop and test a hypothesis concerning a relationship between global economic and ecological systems. (SOSE SRP 6.1)	**AS B6.1** Students predict the consequences of attempts to reform economic, political or ecological systems. (SOSE SRP D6.1).
AS 6.2 Students describe the methods of reproduction in plants and animals, and examine scientific means of controlling desirable features in agricultural plants and animals.	**AS B6.2** Students predict and discuss the variations and implications of plant and animal breeding.
AS 6.3 Students use scientific ideas (including concepts of genetics and natural selection) to explain how variation in living things leads to change in species over time. (Sc LL 6.2)	**AS B6.3** Students envision possible future effects of the manipulation of reproductive processes and genetic inheritance. (Sc LL DB 6.2)
AS 6.4 Students participate in the management of selected agricultural enterprises and explain the advantages and limitations of different husbandry practices used for similar enterprises.	**AS B6.4** Students develop and implement agricultural activities using agreed management and husbandry practices.
AS 6.5 Students use technology practice (as described in the Level 6 core learning outcomes in the *Years 1 to 10 Technology Syllabus*) to promote effective agricultural production (see appendix 1).	**AS B6.5** Students use technology practice (as described in the Beyond Level 6 learning outcomes in the *Years 1 to 10 Technology Syllabus*) to promote effective agricultural production (see appendix 1).
Supplementary learning outcome **AS 6.6** Students evaluate different management systems for an agricultural enterprise.	

Key:

- Sc — in *Years 1 to 10 Science Syllabus*; Strand: LL — Life and Living.
- SOSE — in *Years 1 to 10 Studies of Society and Environment Syllabus*; Strand: SRP — Systems, Resources and Power.

*L*earning outcomes

Agriculture and Society

Organisers for the learning outcomes in the Agriculture and Society strand are:

- agriculture — past, present and future
- agriculture, science and technology
- agriculture and the environment
- agriculture and the economy.

Level 4	Level 5
Level statement	**Level statement**
Students understand the contribution of agriculture to our past and the relationship society had with agriculture. They analyse the impact of science on agriculture. They predict the impact of changes on environments. They understand how agriculture contributes to the local economy.	*Students understand that scientific ideas have changed over time. They understand that applications of science and technology are influenced by social attitudes. They evaluate impacts of a proposed agricultural project on natural systems. They explain how economic factors that affect Australian agriculture also affect the Australian economy.*
Central learning outcomes	**Central learning outcomes**
SO 4.1 Students describe some major changes in farming methods that have contributed to the development of Australian agriculture.	**SO 5.1** Students consider how and why agricultural ideas have changed over time.
SO 4.2 Students present analyses of the short- and long-term effects of some of the ways in which science is used. (Sc SS 4.3)	**SO 5.2** Students analyse the relationship between social attitudes and decisions about the applications of science. (Sc SS 5.3)
SO 4.3 Students predict the impact of changes on environments by comparing evidence. (SOSE PS 4.2)	**SO 5.3** Students design strategies for evaluating environmental impacts of a proposed project, highlighting relationships within and between natural systems. (SOSE PS 5.2)
SO 4.4 Students investigate how agriculture in the local area contributes to the economy of the area.	**SO 5.4** Students analyse and explain the relationship between Australian agriculture and the Australian economy.
Supplementary learning outcomes	**Supplementary learning outcomes**
SO 4.5 Students investigate and describe the contribution of agriculture to the local economy in the past.	**SO 5.5** Students explain the role of the media in developing public opinion about farming practices.
SO 4.6 Students participate in a field study to recommend the most effective ways to care for a place. (SOSE PS 4.3)	**SO 5.6** Students evaluate ideas about sustainability as they identify who may benefit and who may be disadvantaged from changes to agriculture in Queensland.

Key:

- Sc — in *Years 1 to 10 Science Syllabus*; Strand: SS — Science and Society.
- SOSE — in *Years 1 to 10 Studies of Society and Environment Syllabus*; Strand: PS — Place and Space.

*L*earning outcomes

Agriculture and Society

Organisers for the learning outcomes in the Agriculture and Society strand are:

- agriculture — past, present and future
- agriculture, science and technology
- agriculture and the environment
- agriculture and the economy.

Level 6	Beyond Level 6
Level statement	**Level statement**
Students understand the effects of changes currently taking place in the agricultural industry. They use scientific concepts to evaluate costs and benefits of science to aspects of agriculture. They propose ways to resolve environmental issues. They can also predict the economic benefits from local agricultural enterprises.	*Students predict the effects of development on agricultural industries. They analyse society's responses to particular technologies and undertake collaborative research with the local community to promote sustainable consumption. They understand agriculture's potential to contribute to the Australian economy.*
Central learning outcomes	**Supplementary learning outcomes**
SO 6.1 Students identify areas of change in an agricultural industry and explain possible current and future effects on the industry.	**SO B6.1** Students make predictions about future effects of continuing development on agricultural industries.
SO 6.2 Students use scientific concepts to evaluate the costs and benefits of applications of science (including agricultural and industrial practices). (Sc SS 6.3)	**SO B6.2** Students analyse society's responses to technologies that may benefit agriculture.
SO 6.3 Students create proposals to resolve environmental issues in the Asia–Pacific region. (SOSE PS 6.2)	**SO B6.3** Students use modes of delivery appropriate for informing and persuading different audiences to promote ecologically and economically sustainable futures. (SOSE PS D6.2)
SO 6.4 Students evaluate the economic potential of a range of local agricultural enterprises.	**SO B6.4** Students analyse trends in agriculture and make predictions about the potential contributions of agriculture to the Australian economy.
Supplementary learning outcome	
SO 6.5 Students investigate how the effects of changes in farming practice impact on the costs of the products.	**SO B6.5** Students predict where labour shortages and surpluses will occur in the near future in farming and agribusiness.

Key:

- Sc — in *Years 1 to 10 Science Syllabus*; Strand: SS — Science and Society.
- SOSE — in *Years 1 to 10 Studies of Society and Environment Syllabus*; Strand: PS — Place and Space.

*L*earning outcomes

Agricultural Mechanics and Construction

Organisers for the learning outcomes in the Agricultural Mechanics and Construction strand are:

- agricultural mechanics
- agricultural construction — nature of materials
- agricultural construction — techniques with materials
- agricultural safety
- technology practice — mechanics and construction.

Level 4	Level 5
Level statement	**Level statement**
Students understand how different types of engines operate. They select, use and evaluate the suitability of a range of techniques and materials to construct products used in agricultural contexts. They propose ways of responding to unsafe situations. They use technology practice to promote effective agricultural production.	*Students understand how engines operate and ways to maintain them. They compare and contrast materials, and use equipment and techniques to meet predetermined standards when constructing products used in agricultural contexts. They understand how to manage risk in unsafe situations. They use technology practice to promote effective agricultural production.*
Central learning outcomes	**Central learning outcomes**
MC 4.1 Students explain the principles of engines used in agricultural enterprises.	**MC 5.1** Students demonstrate the operation of engines and procedures for engine maintenance.
MC 4.2 Students explain how characteristics of materials affect ways they can be manipulated. (Tech MAT 4.1)	**MC 5.2** Students compare and contrast materials according to their characteristics to determine how effectively the materials meet predetermined standards. (Tech MAT 5.1)
MC 4.3 Students employ their own and others' practical knowledge about equipment and techniques for manipulating and processing materials in order to enhance their products. (Tech MAT 4.2)	**MC 5.3** Students operate equipment and apply techniques for manipulating and processing materials to meet predetermined standards. (Tech MAT 5.2)
MC 4.4 Students propose ways of responding to situations and behaviours that are unsafe, harmful or risky, after assessing options and consequences. (HPE PH 4.3)	**MC 5.4** Students demonstrate behaviours and actions to provide care or manage risk in responding to unsafe or risky situations and behaviours. (HPE PH 5.3)
MC 4.5 Students use technology practice (as described in the Level 4 core learning outcomes in the *Years 1 to 10 Technology Syllabus*) to promote effective agricultural production (see appendix 1).	**MC 5.5** Students use technology practice (as described in the Level 5 core learning outcomes in the *Years 1 to 10 Technology Syllabus*) to promote effective agricultural production (see appendix 1).
Supplementary learning outcome	
MC 4.6 Students work safely when adapting and improvising materials and tools to construct agricultural artefacts.	

Key:

- HPE — in *Years 1 to 10 Health and Physical Education Syllabus*; Strand: PH — Promoting the Health of Individuals and Communities.
- Tech — in *Years 1 to 10 Technology Syllabus*; Strand: MAT — Materials.

*L*earning outcomes

Agricultural Mechanics and Construction

Organisers for the learning outcomes in the Agricultural Mechanics and Construction strand are:

- agricultural mechanics
- agricultural construction — nature of materials
- agricultural construction — techniques with materials
- agricultural safety
- technology practice — mechanics and construction.

Level 6	Beyond Level 6
Level statement	**Level statement**
Students disassemble engines and make repairs. They understand the impacts of materials and use specialised equipment and techniques when constructing products used in agricultural contexts. They understand the risks involved when working in agricultural contexts and develop strategies to respond to unsafe situations. They use technology practice to promote effective agricultural production.	*Students understand the mechanics of transmission of power in agricultural machinery. They design and construct innovative agricultural products using equipment and techniques that approximate commercial or industrial standards. They explore community strategies that promote safety in agricultural contexts. They use technology practice to promote effective agricultural production.*
Central learning outcomes	**Supplementary learning outcomes**
MC 6.1 Students disassemble engines, carry out simple repairs and reassemble.	**MC B6.1** Students demonstrate the mechanics of a range of agricultural tools and machines.
MC 6.2 Students incorporate in their design proposals ideas about the impacts of particular materials used in products. (Tech MAT 6.1)	**MC B6.2** Students challenge traditional uses of materials by applying their understandings about the characteristics of materials in the creation of innovative products. (Tech MAT B6.1)
MC 6.3 Students use specialised equipment and refined techniques to make quality products to detailed specifications. (Tech MAT 6.2)	**MC B6.3** Students use a variety of equipment and techniques to approximate commercial or industrial standards when combining or modifying materials. (Tech MAT B6.2)
MC 6.4 Students devise personal and community strategies to respond to potentially unsafe situations and behaviours. (HPE PH 6.3)	**MC B6.4** Students identify and evaluate community initiatives to promote safety. (HPE PH DB 6.3)
MC 6.5 Students use technology practice (as described in the Level 6 core learning outcomes in the *Years 1 to 10 Technology Syllabus*) to promote effective agricultural production (see appendix 1).	**MC B6.5** Students use technology practice (as described in the Beyond Level 6 learning outcomes in the *Years 1 to 10 Technology Syllabus*) to promote effective agricultural production (see appendix 1).
Supplementary learning outcome	
MC 6.6 Students plan, design and prepare sites for the construction of permanent and semipermanent agricultural artefacts such as gates, fences, races and crushes.	**MC B6.6** Students operate and maintain a range of agricultural machines while complying with safety standards.

Key:

- HPE — in *Years 1 to 10 Health and Physical Education Syllabus*; Strand: PH — Promoting the Health of Individuals and Communities.
- Tech — in *Years 1 to 10 Technology Syllabus*; Strand: MAT — Materials.

Using learning outcomes to plan for learning and assessment

Learning outcomes provide a framework for planning learning and assessment by describing what it is that students should know and be able to do with what they know. Using learning outcomes for planning involves:

- adopting a learner-centred approach to learning and teaching
- planning learning activities and assessment at the same time
- assisting students to work towards demonstrating their learning
- establishing clear expectations of student demonstrations as a basis for monitoring the progress of student learning.

The learning outcomes are sequenced conceptually in four progressive levels. This conceptual development is represented in the level statements for each strand. Learning outcomes at each level are qualitatively different from the corresponding learning outcomes at the levels before and after. This sequencing across levels helps teachers plan learning activities to cater for the range of developmental characteristics of students.

When planning units of work, teachers could select learning outcomes from within a strand, across strands, across levels or across subject areas and key learning areas. Assessment tasks provide opportunities for students to demonstrate their learning.

Planning should make provision for students to demonstrate learning in more than one context and on more than one occasion. Activities incorporating a variety of content and contexts should be organised to provide these opportunities. Planning for learning and planning for assessment are concurrent processes. Learning activities can be opportunities for teachers to gather evidence about students' demonstrations of learning.

Central content

The central learning outcomes and central content are the focus for planning learning activities and assessment tasks.

The organisation of content within a strand should not be considered hierarchical. Any of the content can be considered at any level; not all of the content need be selected at every level. Central content should be selected to suit students' needs, interests and abilities and to take account of their prior knowledge and experiences.

In the Agricultural Education subject area, there is an overlap of central content across strands. For example, safety is in the central content for the Agricultural Mechanics and Construction strand, but is also relevant to other strands.

The central content of each strand is identified on the following pages.

Central content

Agricultural Systems

Agriculture — a local and global perspective

- agriculture, economies and ecosystems
  - Australian agriculture's links with local and global economic and ecological systems
  - relationships between agricultural systems and governments, economies and ecological systems.

Characteristics and science of agricultural plants and animals

- anatomy and physiology of plants and animals
  - anatomy and function of leaves and roots, transpiration, translocation, photosynthesis
  - respiration in plants and animals
  - anatomy and conformation of digestion in farm animals
- reproduction of plants and animals
  - vegetative reproduction, sexual reproduction in plants and animals
  - technologies of reproduction
  - oestrus cycles, fertilisation, gestation, lactation.

Plant and animal husbandry practices

- optimal conditions for growth of animals
- optimal conditions for growth of plants
- disease prevention and treatment of plants and animals
- plant tropisms
- growth records for plants (planting to harvest) and animals (daily weight gain, feed conversion ratios).

Technology practice — agricultural systems*

- investigation
- ideation
- production
- evaluation
- impacts and consequences.

Workplace health and safety

- risks associated with working with plants and animals
- safe behaviour when working with plants and animals.

* Refer to appendix 2 for core content of Technology Practice.

Central content

Agriculture and Society

Agriculture — past, present and future

- changes in agriculture
  - changes in power sources and improvements in machinery
  - methods of irrigation and soil conservation technology
  - improvements in varieties of plants and animals
  - the ways farming communities lived in the past and live now.

Agriculture, science and technology

- changing scientific ideas
  - approaches to plant and animal diseases
  - methods of production and labour required
- future activities
  - developments in mechanisation; population increase and food production biotechnology; new methods of disease control; farming of new species
- societies and agriculture over time
  - attitudes of different groups to agriculture
  - people and work in agriculture
  - influence of education and the media on attitudes
  - new biotechnologies in plant and animal industries
  - genetic manipulation of food
- costs and benefits of technologies in agriculture
  - population increase and food production; use of fertilisers and run off; land clearing, erosion and salinity; crop pesticides and production; stocking rates and land condition.

Agriculture and the environment

- sustainable agriculture
  - agriculture's impact on ecosystems
  - nature and causes of land degradation
  - land management.

Agriculture and the economy

- agriculture and the local economy
  - enterprises and products
  - employment
  - secondary agricultural industries
- agriculture and the Australian economy
  - main agricultural enterprises in Australia
  - domestic consumption of agricultural products
  - agricultural exports
- economic outlook for agriculture
  - local and overseas markets.

Central content

Agricultural Mechanics and Construction

Agricultural mechanics

- internal combustion engines
  - two-stroke and four-stroke engines
  - coil and electronic ignition
  - fuel injection, compression and combustion
  - operation of valves, timing, pistons and crankshaft
- small engine maintenance
  - water and air cooling systems
  - lubrication principles
  - carburettor and fuel injection systems
  - alternators, batteries and supplementary electrics
  - servicing
- engine repairs
  - ignition systems, fuel lines and injectors, electrical systems.

Agricultural construction — nature of materials and techniques for manipulating materials

- tool and material requirements
  - choosing suitable tools and materials
  - testing products in terms of suitable tools and materials
- working safely and accurately
  - reading plans
  - matching and adjusting tools for accuracy
- considering specified standards and safety
  - workplace health and safety issues
  - correct techniques for specific jobs
  - specific risk and safety measures
  - organisation of the workplace.

Agricultural safety

- responding to risky situations
  - safe behaviour when working with tools and equipment
  - risks with animals
  - dangers using chemicals
- common dangers
  - classifying types of risks
  - accident statistics on common dangers with machines
  - risk-management behaviour.
- risk-management behaviour
  - action in risky situations
  - first aid
  - judging whether situations are dangerous
  - deferring to experts in risky situations
  - learning the risks before using equipment

Technology practice — mechanics and construction*

- investigation
- ideation
- production
- evaluation
- impacts and consequences.

* Refer to appendix 2 for core content of Technology Practice.

Assessment

Assessment is the purposeful, systematic and ongoing collection of evidence for use in making judgments about students' learning. In this syllabus, the central learning outcomes are presented in levels of increasing sophistication and complexity to form continua of learning. The assessment focuses on monitoring demonstrations of learning to provide evidence of student progress in this subject area.

Purposes of assessment

Information obtained from assessment can be used for a variety of purposes, including providing feedback on students' learning and informing decision making about students' progress.

Providing feedback

Assessment:

- provides ongoing feedback on the progress of individual students and groups of students throughout the learning and teaching process
- informs students, teachers, parents/carers, others in the community and/or school authorities about students' learning.

Informing decision making

Assessment information helps teachers to:

- make decisions about student needs, the learning and teaching process, and resource requirements
- plan learning and teaching programs for individuals, classes and the whole school
- discuss future learning pathways with students and parents/carers
- make decisions about providing learning support to particular groups of students
- develop learning resources and curriculum materials.

Principles of assessment

For assessment to be effective, it should:

- focus on learning
- be comprehensive
- be valid and reliable
- take account of individual learners
- be an integral part of the learning and teaching process
- provide opportunities for students to take responsibility for their own learning and for monitoring their own progress
- reflect equity principles.

Focus on learning

Assessment should focus on what students are expected to know and be able to do with what they know. Students should be made aware of what is being assessed, how and when they will be assessed, and how judgments will be made about their demonstrations of learning. Teachers may then use information from assessment to plan further learning.

Comprehensive range of evidence

Judgments about students' demonstrations of learning should be based on a comprehensive range of evidence gathered and recorded over time. To collect such evidence, teachers need to provide multiple opportunities in a variety of contexts for students to demonstrate what they know and can do with what they know, and use a variety of assessment techniques and recording instruments. Because students have different learning styles, evidence should be gathered from various sources. (Examples of assessment techniques, recording instruments and sources are provided in table 1 on page 30.)

Valid and reliable evidence

Assessment should provide valid and reliable evidence. It is essential that judgments about what students know and can do with what they know are based on a broad range of evidence gathered and recorded over time. Teachers' judgments should be consistent within their own classes for different students, for different assessment opportunities, and at different times. They should also be consistent with the judgments of other teachers in their own school and other schools.

Individual learners

At any one time in their schooling, students could demonstrate their learning in different ways and at different levels. When planning assessment, teachers need to take account of the fact that each student will progress at a different rate across and within the subject area. They also need to take account of factors that influence students' learning — in particular, their prior knowledge, experiences and unique circumstances, and their social, emotional, physical, cognitive and linguistic development.

Integral part of learning and teaching process

Assessment is an integral part of the learning and teaching process and should support students' learning. As teachers plan learning activities, they should also plan how they will monitor student progress. Learning activities can be used as opportunities to gather evidence about the progress of students' learning. Assessment opportunities should match the learning activities and teaching methods students have experienced. Assessment opportunities should be meaningful, interesting and challenging, and contribute to the development of students as lifelong learners.

Responsibility for own learning and self-monitoring

Assessment should provide feedback and help students take responsibility for their own learning. This involves giving students opportunities to set their own learning goals, to monitor their progress in relation to their learning, and to gather information that they and others can use to make decisions about future learning. Opportunities also need to be provided for students and teachers to develop shared understandings about how learning might be demonstrated, and for students to explain in their own terms how they might demonstrate their learning.

Equity principles

Assessment based on principles of equity enables students to demonstrate learning in ways that are sensitive to, and inclusive of, their circumstances. When planning and conducting assessment, teachers need to take account of students' learning styles, abilities, disabilities, gender, sexual identity, socioeconomic circumstances, cultural and linguistic backgrounds, and geographical locations. This includes:

- providing assessment opportunities that assist students, or groups of students, to overcome barriers that might limit their demonstrations of what they know and can do with what they know
- negotiating assessment with students so that they maximise their opportunities to demonstrate their learning.

Process of assessment

The process of assessment involves:

- providing students with opportunities to demonstrate what they know and can do with what they know
- gathering and recording evidence of students' learning
- using the evidence to make overall judgments about students' learning.

Opportunities to demonstrate learning

Students should have multiple opportunities to demonstrate the learning that has been the focus of planned activities. Assessment opportunities need to be provided over time and in a range of contexts. Teachers can use learning activities as assessment opportunities, or design specific tasks that provide students with opportunities to demonstrate their learning.

Gathering and recording evidence

Evidence about students' learning should come from several different sources and be gathered and recorded over time using a variety of assessment techniques and recording instruments. This evidence should be relevant to the learning being assessed and should be collected in a focused and systematic way.

Sources of evidence

Using evidence from a variety of sources accommodates different learning styles, the different ways in which students may demonstrate learning, and learning that has taken place in different contexts. Sources of evidence can include learning activities as well as specifically designed assessment tasks. Examples of activities, tasks, products or processes that could be used as sources of evidence are shown in table 1.

Assessment techniques

Assessment techniques include observation, consultation and focused analysis. Peer- and self-assessment can also be used to gather evidence about students' learning. Combinations of these techniques provide teachers with more comprehensive evidence on which to base judgments.

Assessment techniques should be selected to suit the context in which the learning is being demonstrated, and the type of evidence required. Teachers should familiarise students with the techniques through modelling and practice. Descriptions of these techniques are provided in table 1.

Record keeping

Record keeping must support planning and be manageable and easily maintained. It must also provide accurate evidence drawn from a range of contexts.

Teachers need to keep records on observation, consultation, focused analysis and peer- and self-assessment. Several examples of recording instruments are listed in table 1.

A **student folio** is a useful way of collating and storing evidence about a student's learning. Folios are developed over time and can include evidence such as responses to assessment tasks, products from learning activities, annotated samples of work, anecdotal records, checklists, photographs or video/audio tapes. This collection of work provides an informative picture of a student's accomplishments. Materials for the folio could be selected by the student or the teacher, or by negotiation between the two.

The use of the folio will determine which materials are included. Examples of folios include working folios for ongoing feedback, documentary folios for making judgments, and show folios for reporting and comparing judgments.

Table 1: Examples of ways to gather and record evidence from a variety of sources

Sources of evidence	Assessment techniques	Recording instruments
Students can provide evidence about what they know, and can do with what they know, in a variety of forms. These include: • practical tasks such as participation in plant or animal enterprises, group tasks, displays/shows, simulations, constructed models, use of agricultural tools and equipment • oral tasks such as discussions, seminar presentations, debates, demonstrations, persuasive speeches, interviews • project folios including design briefs, design ideas, management plans and procedures, data collection and results (trials, tests, surveys), project diary • diaries/journals/learning logs of items such as management processes, group consultations • written tasks such as short and extended responses, instructions, explanations, reviews, creative writing, planning sheets, reports • computer-generated presentations/projects such as enterprise proposals, presentation of data and findings • photographic, video/audio tapes or multimedia records such as explanations of processes or demonstrations of products • peer- and self-reflection through feedback from small or large group discussions or responses to evaluation questions.	**Observation** Teachers observe students as they participate in planned activities. Teacher observation occurs continually as a natural part of the learning and teaching process and can be used to gather a broad range of evidence about students' learning. Teacher observations can also be structured to gather particular kinds of information in relation to learning. **Consultation** Teachers discuss student work with students, colleagues, parents/carers or other paraprofessionals. The varying perspectives of the participants in consultations can help enrich the evidence gathered about students' learning. Consultation can be used to verify the evidence gathered using other techniques. Some consultation may reveal a need for more detailed assessment. **Focused analysis** Teachers examine in detail student responses to tasks or activities. This technique provides detailed evidence about students' learning. **Peer- and self-assessment** Students use the above techniques to assess their own work and the work of their peers. Peer- and self-assessment allow teachers to take account of students' perceptions when gathering evidence.	Teachers can record their judgments about students' learning using a variety of instruments. Recording instruments include: • anecdotal records • teacher/student journals • folios • checklists • statements of anticipated evidence or criteria sheets • annotated work samples • audio and visual recordings (including photographic and video or multimedia) • test results over time • observation notes • feedback sheets • peer- and self-assessment sheets • profiles • progress charts.

Making judgments about demonstrations of learning

Judgments about what students know, and can do with what they know, are an integral and ongoing part of the assessment process. For example, throughout the assessment process, teachers make judgments about:

- students' responses to particular assessment tasks
- what students know and can do with particular content

Such judgments are part of the ongoing monitoring of student progress and inform planning for future learning activities and assessment opportunities. The criteria on which judgments are to be based should be drawn from students' learning and made known to students before tasks are undertaken so that the basis for judgments is clear.

Teachers make judgments about students' learning when satisfied that they have sufficient evidence. In making these judgments, teachers need to:

- analyse what it is that students are expected to know and be able to do with what they know
- consider how student learning has progressed
- use a range of evidence
- make judgments about what learning a student has demonstrated.

Some students may be able to demonstrate what they know and can do with what they know the first time they have an opportunity to do so. When they have additional opportunities that result in further demonstrations, they are considered to have demonstrated learning consistently. Other students may need more opportunities to demonstrate their learning before the same decision can be made. A judgment can be made when a consistent pattern of demonstrations has been established.

The exercise of each teacher's professional judgment is fundamental to the assessment process. Decisions should be based on explicit criteria, using a range of evidence to determine demonstrations of learning. Judgments about a student's demonstrations of learning should be made without reference to the performance of other students.

Consistency of teacher judgments

To be consistent, teacher judgments about students' learning must hold true in later situations and be comparable with the judgments of other teachers.

An individual teacher's judgments need to be consistent:

- within their own classes for different students
- for different assessment opportunities at different times
- with those of other teachers in the same school (i.e. consistency within schools)
- with those of teachers in other schools (i.e. consistency among schools).

Strategies for ensuring consistency of teacher judgments include:

- ***sharing understandings about the learning***: Teachers discuss what students have to know and do to demonstrate their learning.
- ***collaborative planning***: Teachers work together to plan for learning and assessment, and to reach shared understandings about what is required for learning to be demonstrated. Collaborative planning in middle or secondary schools may involve teachers of the same year level, teachers of consecutive year levels, or teachers with subject expertise in two or more areas. Teachers might also plan collaboratively, especially for the transition from Year 7 to Year 8.
- ***common assessment tasks***: Teachers cooperatively plan and/or moderate assessment tasks focusing on the intended learning. This allows teachers to develop shared understandings about what students are expected to know and do with what they know.
- ***statements of anticipated evidence, or criteria sheets***: Teachers identify the properties, components or dimensions by which students' demonstrations of learning will be judged. In developing a common statement of anticipated evidence, or criteria sheet, teachers collaboratively analyse the intended learning to identify and record the anticipated evidence or criteria that will be used as the basis for judgments. Anticipated evidence could be identified in a design brief, criteria sheet, assessment task or verbal description.
- ***moderation processes (formal and informal)***: Teachers discuss and compare judgments made about students' work and associated demonstrations of learning. Formal moderation processes occur when school authorities require teachers from within or among schools to discuss the consistency of judgments about demonstrations of learning. Informal moderation occurs any time that teachers discuss and compare their judgments of students' work.
- ***samples of typical responses***: Teachers compile, and refer to, samples of student work that show how learning may be demonstrated. The samples could be annotated samples of student responses to selected assessment tasks.

Reporting

Reporting is the process of communicating timely, accurate information about students' learning. Its main purpose is to acknowledge and support student learning. Reporting may be formal or informal.

Reporting to students and parents/carers

Teachers need to provide regular feedback to students and parents/carers about student learning and progress. This kind of reporting is an important and ongoing part of the learning and teaching process and can occur incidentally as well as in planned ways.

Students and parents/carers also need to be provided with information about student progress at certain points in time as identified by schools in their overall plans for learning, assessment and reporting.

Reporting on student progress in relation to learning

Information reported to students and parents/carers as part of the ongoing learning and teaching process could include:

- explanations of particular assessment opportunities
- evidence about demonstrations of learning
- judgments about demonstrations of particular learning
- clarification of what students are expected to know, and be able to do with what they know, and how their learning could be demonstrated
- identification of future assessment opportunities and anticipated evidence.

Information reported to students and parents/carers at particular points in time could include:

- records of the learning previously demonstrated by the student
- descriptions of the learning that students have had opportunities to demonstrate since reporting last occurred
- statements about what students were expected to know, and do with what they know, to demonstrate their learning
- descriptions of the contexts in which learning and assessment have occurred
- records of the learning demonstrated by the students since the previous report
- information that is specific to individual students, such as the student's self-assessment, goals or future learning plans.

Language, formats and modes of reporting

The language, formats and modes used for reporting should be meaningful and relevant to the proposed audience. Possible modes for reporting include:

- written reports (print or electronic)
- student–teacher conferences
- teacher–parent/carer interviews
- student-led three-way conferences (student, teacher and parents/carers)
- culminating presentations
- portfolios (print or electronic).

Guidelines

Planning courses of study

Subject area syllabuses broaden the curriculum choice and specialisation for students during the later years of compulsory schooling — that is, during middle and lower secondary schooling. The Agricultural Education subject area syllabus allows teachers to develop a variety of courses of study that meet the specific needs and interests of students.

Learning outcomes for a course of study should be selected on the basis of how best they complement each other and how they collectively fulfil the intent of the course of study. They may be selected from the Agricultural Education subject area syllabus or combined with learning outcomes from other syllabuses. For example, an agricultural course of study can be planned using the learning outcomes from:

- the *Agricultural Education Subject Area Syllabus and Guidelines*
- the *Agricultural Education Subject Area Syllabus and Guidelines* and a key learning area syllabus (or syllabuses)
- the *Agricultural Education Subject Area Syllabus and Guidelines* and another subject area syllabus (or syllabuses).

The learning outcomes within subject area syllabuses are not mandated. Schools may develop courses of study using a subset of the learning outcomes described within the strands. Central learning outcomes, together with some or all of the supplementary learning outcomes, can be used to develop courses of study.

Decisions about learning outcomes selected for a course of study will be influenced by:

- school and school authority policies
- the place and role of the subject area course of study within the total school curriculum.

Agricultural courses of study

Worthwhile agricultural courses of study:

- provide opportunities for students to understand and use agricultural practice
- take account of seasonal variations
- take account of legal requirements
- take account of the availability of school facilities and resources.

Agricultural practice

Students use agricultural practice to design, plan, implement and evaluate agricultural enterprises, activities and equipment. Agricultural practice involves aspects of ‘working technologically’ and ‘working scientifically’.

'Working technologically' is the term used to describe a way of working that interweaves technology practice, information, materials and systems with considerations of appropriateness, contexts and management (as described in the *Years 1 to 10 Technology Syllabus*). The implicit purpose of 'working technologically' is the creation of products that enable people to meet their needs and wants and to capitalise on opportunities.

All products of technology have impacts and consequences. When 'working technologically', people make choices and value judgments about the relative merits and impacts of the processes and products of technology.

'Working scientifically' is the term used to describe the practices and dispositions of science. These include a complex assortment of activities, mental processes, routines and protocols that are the essence of the scientific enterprise. When 'working scientifically', students make sense of the phenomena they experience as they investigate, understand and communicate. (The aspects and components of 'working scientifically' are described in the *Years 1 to 10 Science Syllabus*.)

The nature of the agricultural enterprise or activity in which students engage will determine those aspects of agricultural practice that are required. For example, students involved in a horticultural enterprise may use aspects of 'working scientifically' when they determine fertilisation requirements, and may use aspects of 'working technologically' when they design and produce a watering system for the plants.

Seasonal variations

Seasonal variations should be considered when planning agricultural courses of study that include plant and/or animal growth. Planning that takes account of these variations will maximise the effectiveness of learning experiences. Planning opportunities for students to observe and participate in the growth and care of plants and/or animals requires consideration of husbandry routines, cyclical and intensive production routines and the seasonal variations that affect these. Where possible, courses of study and learning experiences should be timed to maximise opportunities for students to observe and participate in production and husbandry routines.

Learning activities related to husbandry and production practices should include intellectual challenge, cooperative learning and time for discussion, reflection and development of new understandings. Students should be able to explain why routines are essential and the consequences when these routines are neglected. This approach to husbandry routines provides opportunities for students to develop positive dispositions towards the care of plants and animals.

Legal requirements

Agricultural courses of study are conducted subject to a range of legislation and regulations. Courses of study in agriculture must be planned taking account of legal requirements.

The underlying principle of legislation and regulations is protection for the people who work in the industry, the consumers who use the products, and the animals, plants and environment used in the process.

Safety

All learning activities undertaken in this subject area must be planned and conducted with due regard for the safety of all concerned. The legal requirements to do so are described in the documents listed below.

Teachers and students must follow safe work practices in a designated area free of avoidable hazards. They must be provided with appropriate safety equipment. Students should not participate in activities until they have been advised of the risks involved and provided with demonstrations of correct procedures. Staff and facilities must have current accreditation or certification for proposed activities and relevant material safety data sheets (MSDS) must be available and used to identify risks and precautions. Whenever specific tools or equipment are used, teachers/supervisors must ensure their safe use as described in the manufacturer's instructions.

The standards for establishing and maintaining a safe workplace in Queensland are set by the *Workplace Health and Safety Act 1995*. This Act provides for a number of regulations, advisory standards and codes of practice that apply to specific industries — for example, Workplace Health and Safety Regulation 1997, and Workplace Health and Safety (Miscellaneous) Regulation 1995.

The Department of Education and the Arts has developed policies related to risk assessment and risk management. The *Department of Education Manual* is available on their website. The following modules are specifically for planning courses of study in agriculture:

- HS-10-12, HS-10-48 Handling Live Animals
- HS-10-13 Tractor Driving
- HS-10-14 Power-generating Equipment
- HS-10-15 Agricultural Construction
- HS-10-16 Stockyards
- HS-10-17 Fencing Construction
- HS-10-18 Agricultural Machinery
- HS-10-19 Agricultural Chemical Management
- HS-10-20 Gardening and Non-workshop Hand Tools
- CS-29 Animal Ethics and Welfare in Schools.

To view copies of these modules, go to http://education.qld.gov.au/corporate/doem/, click on 'Health & Safety' at the top of the page, then 'HS-10-1 – HS-10-121'. Alternatively, go directly to http://education.qld.gov.au/corporate/doem/healthsa/healthsa.html.

Animal welfare

The *Animal Care and Protection Act 2001* and the accompanying Animal Care and Protection Regulation 2002 govern the treatment and use of all animals in Queensland. The Queensland Department of Primary Industries and Fisheries (QDPI&F) is responsible for enforcement of the legislation. The purpose is to prevent animal suffering, to improve the welfare of animals and to ensure all use of animals for scientific purposes is justified, open and accountable. 'Scientific purposes' is defined to include activities for the purposes of demonstration and teaching. The legislation covers animals described as 'any live vertebrate, and includes live prenatal or prehatched creatures in the last half of gestation or development'. Further details of the categories covered by the legislation can be obtained from the QDPI&F web page www.dpi.qld.gov.au/animalwelfare/. Click on the link 'Using animals for scientific purposes'.

The Act also requires compliance with the *Australian Code of Practice for the Care and Use of Animals for Scientific Purposes*, which can be downloaded from the 'Publications' area of the National Health and Medical Research Council's website, www.health.gov.au/nhmrc.

The *Queensland School Animal Use Guidelines* explain what Queensland schools need to do if they are to satisfy the requirements of the *Animal Care and Protection Act 2001*. The Act imposes strict requirements on schools wishing to use animals for teaching. The guidelines provide advice and recommendations for schools using animals in pursuit of their educational objectives and related outcomes. The guidelines will supersede *The Care and Use of Animals in Schools: Policy and Guidelines* published in 1997 and are available in draft form from www.qcec.qld.catholic.edu.au/CurriculumWebsite/Curriculum/.

National agricultural industry codes of practice are available for most livestock industries, and outline acceptable standards of husbandry and management. There are also codes covering areas such as transporting livestock, saleyards and abattoirs. In Queensland, the national livestock codes are used as the minimum standard. Codes may be downloaded from the CSIRO Publishing website at www.publish.csiro.au/nid/22/sid/11.htm.

If animals are to be used for scientific purposes (which include teaching), the Act must be complied with in the following ways:

1. Teachers (or their employing institution) must register with QDPI&F and nominate the Animal Ethics Committee (AEC) that will assess their animal use.
2. All animal use must be approved by the AEC prior to the activity commencing.
3. An annual report needs to be made to the QDPI&F of activities where animals are used.

An employer may register with the QDPI&F as a 'user of animals for scientific purposes' to cover employee activities requiring the use of animals for scientific purposes. An animal ethics application must be made to the AEC for each 'use of animals' or 'type of use of animals' for a series of similar events. AECs may approve activities that are frequently repeated in a school program. Approval can be given for a three-year period but activities must be reported annually to the AEC. Check with your employing authority for details of any guidelines or processes in place to assist you to meet the requirements of the legislation.

Examples of agricultural courses of study

Multiple courses of study with different focuses can be developed from the Agricultural Education subject area syllabus. The following are examples of courses of study that may be planned to meet the needs and interests of students and school communities. These examples provide some preliminary ideas for planning and illustrate the range of courses of study that can be planned.

- An **Agricultural Systems** course of study would focus on learning outcomes from the Agricultural Systems strand. The course may provide opportunities for students to develop and/or participate in plant and/or animal enterprises. The focus would be on husbandry practices associated with the plant and/or animal enterprises and students developing confidence in growing plants and handling animals. Students would have many opportunities to integrate theoretical understandings with practical activities. A school may choose to concentrate on a plant enterprise, an animal enterprise, or plant and animal enterprises.
- An **Agriculture and the Environment** course of study could include learning outcomes from the Agriculture and Society strand. The focus would be on the impacts of agriculture on the environment. The course could provide students with opportunities to evaluate the effects of agriculture or agricultural enterprises on the environment by considering evidence and making judgments. The course of study could also be developed to include learning outcomes from the Studies of Society and Environment and/or Science key learning areas. The course of study could be collaboratively designed and implemented with teachers of Studies of Society and Environment and/or Science.

- An **Agricultural Enterprises** course of study could focus on learning outcomes from the Agricultural Systems and Agricultural Mechanics and Construction strands. The course of study may emphasise a particular enterprise and the associated husbandry practices and farm construction. For example, raising chickens and the construction of equipment required for production may be the focus of the course of study.
- An **Agricultural Mechanics and Construction** course of study could focus on learning outcomes from the Agricultural Mechanics and Construction strand. The course could include the operational theory and maintenance of small engines and the construction of agricultural equipment using a range of techniques, such as welding, fencing and concreting. Learning outcomes related to agricultural safety may also be included.

Planning learning and assessment

An outcomes approach requires that students demonstrate what they know and can do with what they know. In an outcomes approach there is a strong link between learning and assessment, and strategies for these should be planned together. Assessment involves the ongoing and systematic collection of information about students' learning.

Teachers are encouraged to monitor students' learning during everyday activities rather than at the end of a course of study. When planning, teachers should include opportunities for ongoing monitoring and gathering of information about students' learning. Feedback from assessment of these demonstrations, which may be diagnostic, formative or summative, leads to short-term or long-term revision of curriculum plans.

When planning for assessment, it is necessary to identify:

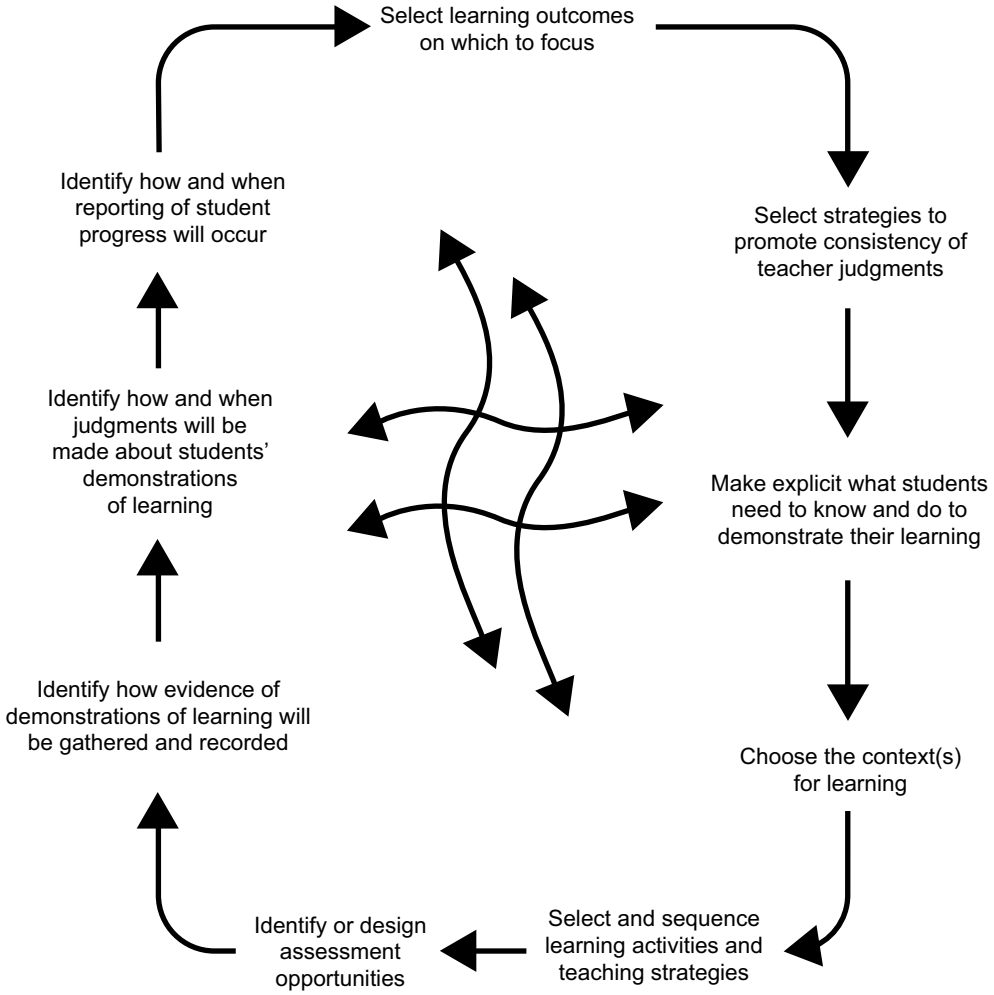
- suitable contexts in which students can demonstrate what they know and can do with what they know
- the anticipated evidence or criteria against which judgments can be made about whether students have demonstrated their learning.

A model for planning units of work

Although individual teachers will approach planning in different ways, when teachers plan using learning outcomes, they:

- select learning outcomes on which to focus
- select strategies to promote consistency of teacher judgments
- make explicit what students need to know and do with what they know
- choose the context(s) for learning
- select and sequence learning activities and teaching strategies
- identify or design assessment opportunities
- identify how evidence of learning will be gathered and recorded
- identify how and when judgments will be made about students' learning
- identify how and when reporting of student progress will occur.

These features are an essential part of long-term planning (e.g. yearly or semester programs) and short-term planning (e.g. units of work). The essential features of the planning process are illustrated in the following model. The model highlights the dynamic and cyclic nature of planning using learning outcomes.



Planning for learning, teaching, assessment and reporting

Planning with central learning outcomes

The major considerations for planning learning opportunities and related assessment are the central learning outcomes.

Activities planned for students should have within them opportunities for student learning and the collection of information about students' demonstrations of learning.

Activities should draw on the central content of the relevant strands.

Elaborations

Elaborations are designed to help teachers understand the intent of the central learning outcomes. They provide examples of possible content and contexts for developing and demonstrating the learning outcomes.

Agricultural Systems

AS 4.1 Students outline how Australian industries link to global economic and ecological systems. (SOSE SRP 4.1)	**AS 5.1** Students evaluate the relationship between an ecological system and a government and/or an economic system. (SOSE SRP 5.1)	**AS 6.1** Students develop and test a hypothesis concerning a relationship between global economic and ecological systems. (SOSE SRP 6.1)
Students know: • **Australian agricultural industries** – primary e.g. sheep, cattle, grain, dairy, mixed farming – secondary e.g. seed and grain companies, marketing – tertiary (provision of services) e.g. ecotourism, research and development, finance • **global economic systems** – agricultural trade between Australia and other countries – countries specialising in different agricultural industries e.g. Australia — sheep, beef, cotton – inequality of resource and income distribution in agricultural contexts – relationship between types of workforce associated with different agricultural industries – United Nations (WHO) programs – trade agreements between Australia and other countries – tariffs on products • **global ecological systems** – terrestrial, fresh water and marine environments	**Students know:** • **relationships exist between ecological systems and governments and/or economic systems** – government restrictions on imports e.g. poultry, seeds – government-funded research e.g. CSIRO and fruit-fly eradication in north Queensland – reserves created via legislation e.g. forestry reserves for reduction of greenhouse emissions and ecotourism – government requirements for environmental impact studies – summits and public consultations to consider effects of development in/or near natural ecosystems – market forces and ecotourism – links between natural resources and an industry's sustainability e.g. timber industry and plantation forestry, fishing and aquaculture, soil conservation and farming – council regulations impacting on agricultural industries e.g. noise and odour levels, waste-water treatment – company policies and practices that promote sustainability and environmental responsibility – corporate sponsorship of endangered areas or animals	**Students know:** • **strategies to develop a hypothesis** – hypothesis should be manageable, relevant and focused • **strategies to test a hypothesis** – relevant data e.g. a variety of search terms to interrogate a database – data can be compared and evaluated e.g. assessments about the reliability of information, statistical data with mapped information – conclusions about the accuracy of the hypothesis can be constructed – local studies may be used to ascertain whether there is a testable relationship on a larger scale – a variety of information that indicates a causal relationship may be identified and located and then compared to anecdotal evidence
Students: • **explain how Australian industries relate to global economic and ecological systems** – identify Australian agricultural industries and related secondary and tertiary industries – find the origins of a range of food products – identify imported products that compete with locally grown/supplied products – identify markets for Australian produce and barriers to potential markets – develop a flow chart of product trade routes – create pictorial maps to show the relationship of an agricultural industry to an ecological system	**Students:** • **analyse the relationship between an agricultural industry and government** – investigate the beef industry e.g. for disease, pest control, government assistance, industry codes of practice – examine government intervention into a free market agricultural economy – investigate the use of natural resources as an economic commodity – invite experts to speak on management practices and ecological and economic sustainability	**Students:** • **develop and test a hypothesis about the economy, ecology and an agricultural industry** – select a global issue that impacts on the economy and ecology of Australian agricultural industries e.g. exotic diseases; land clearing; environmental pollution in feed lots; effects of irrigation; recycling and effluent water; salinity – select a national issue e.g. agriculture in the Murray–Darling basin and its environmental impacts – select an environmental issue e.g. lack of rainfall in sub-Saharan Africa and its impact on agriculture and the economy; market demand for rainforest timber and its impacts on rainforests in Pacific Islands, Indonesia and Malaysia

Agricultural Systems

AS 4.2 Students identify the anatomical features of some plants and animals in relation to their usefulness as agricultural products.	**AS 5.2** Students explain some features of the physiology of plants and animals and relate these to the growth of these plants and animals.	**AS 6.2** Students describe the methods of reproduction in plants and animals, and examine scientific means of controlling desirable features in agricultural plants and animals.
Students know: • **anatomy and function of plant systems** e.g. shoots, flowers, leaves • **anatomical features of animals** – anatomy of agricultural animals – anatomical differences between farm animals – **usefulness of plants and animals as products** e.g. milk, meat, hides, fertiliser, fibre crops, grains	**Students know:** • **physiological features of plants** – transpiration – translocation – photosynthesis – respiration and its relationship to photosynthesis – differences between monocotyledons and dicotyledons • **physiological features of animals** – digestive systems of agricultural animals – respiratory systems – circulatory systems • **plant growth** – requirements e.g. plant nutrition, water, light • **animal growth** – requirements e.g. animal nutrition and health; environmental factors such as shade	**Students know:** • **methods of reproduction** – methods of breeding e.g. cross, pure, line, genetic engineering, artificial insemination, embryo transfer, grafting, budding and cuttings – the oestrus cycle and reproduction in agricultural mammals – role of hormones – flower structure, seed structure and sexual reproduction in a range of agricultural plants – vegetative reproduction methods in a range of agricultural plants • **desirable features** – growth and anatomical characteristics e.g. disease resistance, high yield production, market suitability
Students: – identify anatomical features – observe and label diagrams of the anatomy of plants and animals – grow/study a range of plants to identify their anatomical parts, growing habits and uses – participate in a class excursion to a local show or area to compare different plant and animal species – develop a pictorial collection of plants and animals and their agricultural products – classify products according to their sources and uses e.g. tubers, suckers, bulbs, fruits, vegetables	**Students:** • **explain relationships between physiology and growth** – view virtual dissections – identify the growth characteristics important for a range of agricultural plants and animals – conduct growth trials on animals e.g. poultry nutrition, feed-lot trial, plant fertiliser trial – monitor growth and production of plants and animals e.g. measure honey produced by hives, collect growth rates for cattle	**Students:** • **examine how scientific means can exercise control** – examine scientific methods of reproduction in plants and animals – evaluate the suitability of reproductive methods for particular plants and/or animals e.g. conduct a plant varietal trial – compare growth differences between a range of animal breeds to assess selection for market suitability

Agricultural Systems

AS 4.3 Students identify and analyse similarities and differences in the ways that different living things reproduce. (Sc LL 4.2)	**AS 5.3** Students evaluate different processes and strategies of reproduction (including asexual reproduction and care of young) in terms of their relative efficiency in ensuring survival of offspring. (Sc LL 5.2)	**AS 6.3** Students use scientific ideas (including concepts of genetics and natural selection) to explain how variation in living things leads to change in species over time. (Sc LL 6.2)
Students know: • **ways agricultural plants and animals reproduce** – sexual reproductive processes e.g. structure of flowers, pollen transfer, fertilisation (internal and external), dispersal of seeds, egg formation in poultry, gestation period variation in animals – asexual e.g. vegetative reproduction (cuttings, suckers, tubers, bulbs, runners), budding, grafting, marcotting	**Students know:** • **processes and strategies of reproduction** – contribution of asexual and sexual reproduction to survival of offspring e.g. seedlings versus grafted varieties – maintaining biodiversity by preserving gene pool e.g. seed savers – biotechnology is used to enhance agricultural production e.g. pesticide resistance – animal and plant behaviours that assist survival e.g. courtship behaviours and seed survival mechanisms such as germination triggers – relationship between number of offspring and parental care, nurture, protection, chances of survival	**Students know:** • **concepts of genetics** – cell division to produce gametes – fertilisation — mixing of genetic information produces variety in offspring – role of chromosomes – Mendelian genetics — dominant and recessive characteristics, incomplete dominance, sex-linkage – mutation – genetic variation can lead to change in species – natural selection leads to change in species e.g. evolution of the horse – agricultural plants and animals today have been selected over many years for their desirable characteristics e.g. increase production – modern knowledge of genetics assists in animal and plant breeding by reducing the generations required to produce the desired characteristics
Students: • **analyse similarities and differences in the ways agricultural plants and animals reproduce** – propagate plants using a variety of sexual and asexual means and analyse the similarities and differences – develop a pictorial collection of vegetative reproduction methods – examine pollen or semen from an artificial insemination straw under a microscope – draw diagrams to illustrate reproduction in plants – view videos to investigate reproductive methods – collect seeds and fruit and classify according to differences and similarities in their formation	**Students:** • **evaluate processes and strategies of reproduction in relation to efficiency of ensuring the survival of offspring** – conduct trials comparing seedlings to grafted plants on the basis of growth rate or disease susceptibility – observe and record reproductive behaviours of different farm animals e.g. courtship behaviour of rooster and hen, heat (oestrous) detection – observe and compare the birth and post-natal care of different animals – compare natural and artificial care of young animals	**Students:** • **explain how variation in living things leads to change in species** – use computer simulations of plant seeds to investigate simple genetic theory such as the Mendelian ratio – research the development of particular breeds e.g. Belmont Red, Mandalon Special – solve problems relating to single-inheritance to explain how variation occurs – investigate breeding programs for desired characteristics through visits to animal studs – gather information from plant breeders or seed merchants about the development of new varieties – conduct trials to compare F1 and F2 seeds

Agricultural Systems

AS 4.4 Students participate in selected plant and/or animal enterprises and explain how husbandry practices provide for optimal growth.	**AS 5.4** Students participate as team members and demonstrate husbandry practices for selected plant and/or animal enterprises.	**AS 6.4** Students participate in the management of selected agricultural enterprises and explain the advantages and limitations of different husbandry practices used for similar enterprises.
Students know: • **husbandry practices for optimal growth** – practices to meet requirements for optimum growth of animals e.g. ideal food, water, shelter – practices to meet requirements for optimum growth of plants e.g. ideal soil, temperature, light conditions – effects of restricting requirements on growth or production capacity of the animals – effects of changing growing conditions on a range of plants – need for regularity and consistency in animal and plant husbandry – importance of disease prevention in plants and animals – terms associated with a selected plant and/or enterprise	**Students know:** • **husbandry practices for selected enterprises** – feeding requirements – breeding programs or reproductive technology required – animal health programs e.g. vaccination, drenching – management tools e.g. de-horning, castration, marking – record keeping e.g. breeding and production records – animal welfare e.g. codes of practice	**Students know:** • **selected agricultural practices require different management systems** e.g. poultry in deep litter or free range • **advantages and limitations of different husbandry practices** – capital input costs and returns of different regimes – differences in labour requirements for different regimes – differences in housing, methods of feeding, types of food or density of animals between regimes – differences in cultivation programs, staking, spacing or spraying between regimes in a plant enterprise • **management of agricultural enterprises** – management decisions e.g. data collection and analysis of data for decision making – quality assurance
Students: • **participate in plant and/or animal enterprises** – participate in the handling and care of a range of plants and/or animals e.g. correct restraint of animals, cultivating, watering, fertilising plants • **explain how husbandry practices provide for optimum growth of plants and/or animals** – visit farms and discuss with farmers which practices are used to gain the most from their plant and/or animal enterprises	**Students:** • **participate as a team member** – work independently and collaboratively to undertake husbandry practices e.g. collaboratively determine and implement feeding/watering/observation regimes and rosters • **demonstrate husbandry practices** – investigate and use a range of husbandry practices for particular plants and/or animals e.g. weighing cattle, extracting honey, drenching, marking, vaccinating, pruning, harvesting, cultivating – complete records relating to the husbandry practices e.g. dates of drenching, fertilisation	**Students:** • **participate in the management of selected agricultural enterprises** – establish and maintain agricultural enterprises using two or more accepted systems of management e.g. hydroponics or soil-based systems – decide on major management responsibilities and plan to implement these – cost the projects/activities related to the enterprises • **explain advantages and limitations of different husbandry practices** – report on selected husbandry regimes – visit farms using different husbandry regimes to raise the same crop or animals – invite husbandry-method experts to discuss practices for the chosen agricultural enterprise – evaluate regimes for raising the same plants or animals and make recommendations about the most appropriate regimes

Agricultural Systems

AS 4.5 Students use technology practice (as described in the Level 4 core learning outcomes in the *Years 1 to 10 Technology Syllabus*) to promote effective agricultural production.	**AS 5.5** Students use technology practice (as described in the Level 5 core learning outcomes in the *Years 1 to 10 Technology Syllabus*) to promote effective agricultural production.	**AS 6.5** Students use technology practice (as described in the Level 6 core learning outcomes in the *Years 1 to 10 Technology Syllabus*) to promote effective agricultural production.
The learning outcomes from the Technology Practice strand of the *Years 1 to 10 Technology Syllabus* are reproduced below. These are to be used as a set.		
Students use consultative methods to gather knowledge, ideas and data when researching alternatives within design challenges. (Tech TP 4.1)	Students analyse links between the knowledge, ideas and data gathered to meet design challenges and the design and development of new and improved products. (Tech TP 5.1)	Students formulate detailed plans for gathering knowledge, ideas and data and validate choices of information, sources and methods. (Tech TP 6.1)
Students know: • **consultative methods** e.g. interviews, surveys, discussions, focus groups, questionnaires, online community discussions, teleconferences, meetings, professional advice • **alternatives within design challenges** – ideas, options – advantages and disadvantages of particular ideas and options	**Students know:** • **links between information gathered and the design and development of products** – knowledge, ideas and data inform development of products e.g. data about potential users – new materials, products or techniques – ways of developing products to meet new or emerging needs • **ways to analyse links between information gathered and the development of products** – identify the knowledge, ideas and data that are reflected in the design and development of products, and those that are not reflected – consider how well the product design and development match the knowledge, ideas and data gathered e.g. conduct SWOT and PMI analyses	**Students know:** • **detailed plans for gathering knowledge, ideas and data** – information from a range of sources enhances accuracy and reliability – identify possible sources of information, methods of collecting data and timelines for gathering information • **ways to validate choices of information, sources and methods used to gather information** – consult experts about the validity of information and the methods used e.g. ask workers in agricultural workshops about how they undertake their market research – investigate the reliability of the source e.g. Who has produced the data? What qualifications does the group hold? – cross-reference with information gathered from other sources
Students: • **use consultative methods** – gather information using various methods e.g. talk to people working on a farm or agribusiness to determine how the equipment they use meets their needs; observe the design of equipment they could construct later – use resources that specialists have developed to gather information e.g. internet, email or online communities, brochures, journals • **research alternatives within design challenges** – analyse and compare ideas and information gathered through consultation e.g. for gates, cattle crushes or brooders of different design and construction	**Students:** • **analyse the links between information and the development of products** – analyse how information about the users' needs influences the development of new products e.g. planters that combine fertiliser with seeds, poultry feeders that don't waste food – survey groups of people to determine their needs and wants e.g. define a range of products that could be provided by the school's agricultural section – consult with people who design products to discover how their knowledge of the needs of the community affects their design work e.g. welders, carpenters	**Students:** • **formulate detailed plans for gathering knowledge, ideas and data** – develop an action plan by identifying sources, collection methods, timelines • **validate choices, sources and methods** – evaluate the sources of data and the relevance to the design challenge – identify constraints that impact on the choice of sources and methods e.g. time, cost – provide evidence that the information is accurate, current and from a respected source

Agricultural Systems

Students generate design ideas through consultation and communicate these in detailed design proposals. (Tech TP 4.2)	Students generate design ideas and communicate these in design proposals that indicate an understanding of factors influencing production of the option(s) they have selected. (Tech TP 5.2)	Students generate design ideas and communicate these in design proposals that indicate various options and incorporate management strategies. (Tech TP 6.2)
Students know: • **strategies that lead to the generation of design ideas** e.g. brainstorming, negotiations, discussions, gathering opinions about design proposals • **detailed design proposals** – communicate design ideas – provide background information about the design challenge, product purpose, intended users – show considerations of resources, timelines, product specifications, production procedures • **ways to communicate design ideas** e.g. annotated diagrams, written descriptions, models, prototypes, sketches, scale drawings	**Students know:** • **factors influencing the production of selected options** – human and physical resources e.g. knowledge, time, skills, equipment, technical expertise, availability of materials – considerations of appropriateness e.g. environment, function, culture, social impact – economic factors e.g. cost, sustainability	**Students know:** • **options within design proposals** – resources – production techniques • **management strategies** – strategies to manage resources e.g. people, time, materials, equipment
Students: • **generate design ideas through consultation** – consult with others to develop and refine ideas e.g. with a farmer for grain or root crop, or small animal, enterprises – consult with the teacher or other students to discuss alternative design proposals e.g. for an agricultural enterprise – visit experts to discuss how they plan and design their projects e.g. how a farmer plans an agricultural enterprise • **communicate design ideas in detailed design proposals** – select and use appropriate ways to communicate the details of design proposals – use annotated sketches to communicate ideas for a product	**Students:** • **generate and select design ideas** – devise a range of options – analyse ideas and select the preferred options using strategies e.g. SWOT and PMI analyses – record consultations with clients/users to confirm that design ideas reflect needs and wants – identify impacts and consequences of different ideas – keep anecdotal records and notes of discussions – explain why a design idea was accepted or rejected • **communicate design proposals** – develop written proposals, oral presentations, diagrams, visual presentations, folios – develop sketches, flow charts, drawings, plans, procedures – describe the materials required; methods of production or implementation; sequence of action – use correct and suitable symbols, graphics and language for the intended audience	**Students:** • **incorporate management strategies** – plan to minimise waste – prepare budgets – develop workable timelines by consulting team members – observe and refine workplace procedures – minimise negative impacts of particular practices e.g. negative impacts on the environment – formulate checklists to ensure that the processes used are appropriate e.g. workplace health and safety

Agricultural Systems

Students identify and make use of the practical expertise of others when following production procedures to make products for specific users. (Tech TP 4.3)	Students meet predetermined standards as they follow production procedures to make quality products. (Tech TP 5.3)	Students negotiate and refine production procedures in making quality products that meet detailed specifications. (Tech TP 6.3)
Students know: • **practical expertise of others** – people with specialised knowledge or equipment – research techniques – documentation of the designs and processes of others • **specific users** – identified individuals or groups for whom the product will meet a need/desire – demographic description of a target group by features such as age, gender, occupation	**Students know:** • **predetermined standards** – design briefs or proposals – client specifications – government standards – industrial and commercial standards of quality and performance – desired effects e.g. optimise efficiency, productivity, performance	**Students know:** • **reasons to negotiate and refine production procedures** – minimise waste – enhance product quality – meet timelines and budget requirements – accommodate unforeseen circumstances • **ways to negotiate and refine production procedures** – team consultation and feedback – trials of production procedures – timelines for production – processes that streamline the production – production can be systematised by breaking it into stages – products may be modified to allow different or more simple methods of manufacture
Students: • **identify and make use of practical expertise of others** – identify individuals and groups in the community with expertise – consult people with practical expertise – seek assistance from experts about procedures – observe experts at work – engage mentors for skill development – request feedback and advice • **follow production procedures to make products for specific users** – follow production procedures as detailed in the design proposals e.g. grow crops or raise animals as class projects, develop hydroponic enterprises, construct guinea pig cages – integrate points for feedback from users – organise market research/test groups – meet product specifications as detailed in the design proposals	**Students:** • **follow production procedures** – implement design and production steps – manage resources within constraints e.g. finances, equipment, time • **make quality products that meet predetermined standards** – identify the predetermined standards or client specifications e.g. functionality, cost effectiveness – monitor procedures to reflect standards and modify procedures if required – create aesthetic appeal	**Students:** • **negotiate and refine production procedures** – consult and negotiate with others to refine production procedures in progress e.g. feed the pigs on the school farm for a time before refining the feeding routine – identify and implement alternative production procedures to solve problems as the plan is implemented • **make quality products that meet detailed specifications** – identify the specifications required in design proposals – implement production procedures to meet these specifications – achieve accuracy, quality

Agricultural Systems

Students gather feedback to gauge how well their design ideas and processes meet design challenges and how effectively products meet the needs of specific users. (Tech TP 4.4)	Students use predetermined criteria to judge how well processes and products meet the needs of specific users, and recommend modifications or improvements. (Tech TP 5.4)	Students identify methods for evaluating commercial or industrial products and processes and use these to judge the appropriateness of their own processes and products. (Tech TP 6.4)
Students know: • **how to gather feedback** e.g. simple surveys, interviews, product comparisons, people's reactions to a product, team members' critiques, self-reflection, observations • **how to develop tools for gathering and interpreting feedback** – open or closed questions – compilation and interpretation of data – collate data and identify key messages e.g. record data in tables, calculate percentages, graph data	**Students know:** • how to use predetermined criteria to modify or improve processes and products – strengths and weaknesses of a process or product in relation to the criteria – recommendations for change on the basis of the criteria – similarities and differences between the design ideas and the final processes and production – determining how well users' needs are met	**Students know:** • methods for evaluating commercial or industrial products and processes – product tests and trials – interviews with users – market research e.g. telemarketing, surveys, focus groups – consultations with experts – independent evaluations
Students: • **gather feedback about design ideas, processes or products** – develop a list of criteria to measure the effectiveness of their design e.g. cost of production, quality of the product or enterprise, conditions of production, profitability, management of resources – gauge how well design ideas, processes and products meet design challenges – gauge how effectively products meet the needs of specific users – analyse if resources could have been better invested in a different enterprise – survey the rest of the class, or another class, about the success or otherwise of the enterprise or product – write a brief report comparing the final product or the outcome of the enterprise with the plan	**Students:** • **use predetermined criteria** – identify the criteria – use criteria established by the teacher or others – generate criteria to test their processes, products or services – devise criteria for the purpose of judging and improving documentation – devise criteria for improving production methods and product performance • **judge how well the processes or products match the criteria** – rate the product – describe strengths and weaknesses of processes – carry out product tests – conduct market research – consider a range of ways to evaluate their designs and recognise that the most appropriate design depends on the criteria used to develop the design • **use judgments to make recommendations for changes** – modify a part of a process that could be strengthened	**Students:** • **identify methods for evaluating** – select and use methods e.g. for reliability, feasibility – validate methods for evaluating their own products and processes • **make judgments about the appropriateness of their own processes and products using data gathered** – decide if the processes for conceptualising and making the products have achieved the goal – analyse the data collected during evaluations and draw conclusions about the success of the products – make judgments in devising evaluation criteria in relation to aesthetics, culture, economics, environment, ethics, function, society – ask advice from experts, parents/carers, teachers about documentation, production methods and product performance – compare their documentation, production methods or product performances to those of commercial companies – use their own criteria to evaluate commercial companies' documentation, production methods and product performance

Agriculture and Society

SO 4.1 Students describe some major changes in farming methods that have contributed to the development of Australian agriculture.	**SO 5.1** Students consider how and why agricultural ideas have changed over time.	**SO 6.1** Students identify areas of change in an agricultural industry and explain possible current and future effects on the industry.
Students know: • **major changes in farming methods** – farm power sources and mechanisation – machinery for tillage, crop harvesting and processing – improvements in breeds of plants and animals – methods of irrigation – methods of soil conservation – use of agricultural and veterinary chemicals – use of synthetic fertilisers	**Students know:** • **how and why agricultural ideas have changed** – agricultural lifestyles e.g. ways farming families live and work – role of labour-saving production methods – agricultural management and methods – perceptions of primary producers; plant and animal breeds – changing attitudes towards agricultural practices e.g. plant and animal diseases; agricultural and veterinary use of chemicals; soil conservation; environmental degradation; animal welfare – science and technological innovation e.g. role of agricultural science in research and development; contribution to agriculture of other fields of science and technology – changing economic contexts e.g. consumer demand; impact of market forces	**Students know:** • **areas of change** – new products and markets e.g. species farmed; customisation for niche markets – farming practices e.g. mechanisation; methods of measuring soil moisture linked to new methods of irrigation; integrated pest management; methods of disease control in plants and animals – biotechnology e.g. effects on agricultural ideas; in-built genetic protection for field crop species including insecticides • **effects on the industry** e.g. profits, sustainability, labour force, ecological impact
Students: • **describe major changes in particular aspects of farming methods** – describe how present-day farm machinery has replaced a number of machines and functions of past farm practices e.g. combine harvester – research and report on changes brought about by mechanised technology e.g. the tractor to implement three-point linkage and power take-off – visit museums and 'living farm museums' to compare and contrast farming methods of the past with those of the present	**Students:** • **identify and describe how agricultural ideas have changed** – investigate changes in farm machinery and link these changes to improvements in farm life and economics – report on the contribution of science and technology to selective breeding of plant or animal species and their impacts on economics and society – conduct a field survey on soil degradation problems in the district and analyse the impacts of soil science on management and conservation	**Students:** • **identify and explain possible current effects of these changes** e.g. prepare an advertising campaign to raise awareness about land degradation; prepare and present a debate on the genetic engineering of animals and how these changes have affected and may affect the future of the pastoral industry • **predict future effects on the industry** e.g. create scenarios about irradiation of plant crops and the impacts on future markets and consumer acceptance

Agriculture and Society

SO 4.2 Students present analyses of the short- and long-term effects of some of the ways in which science is used. (Sc SS 4.3)	**SO 5.2** Students analyse the relationship between social attitudes and decisions about the applications of science. (Sc SS 5.3)	**SO 6.2** Students use scientific concepts to evaluate the costs and benefits of applications of science (including agricultural and industrial practices). (Sc SS 6.3)
Students know: • **ways in which science is used in agriculture** – research and development by governments e.g. CSIRO commercial seed and fertiliser companies – farming practices – monitoring e.g. soil testing, health of animals – post-harvest processing e.g. food science, fibre blends, quality control – treatment of products e.g. hides, feed lots, effluent • **short- and long-term effects** – on products produced – on farming practices – on lifestyle **Students:** • **analyse the ways science is used in agriculture to enhance short- and long-term effects** – analyse effects research and development has had on a range of agricultural products e.g. dairy products – analyse short-term effects of conducting scientific tests during cultivation e.g. soil tests when growing a crop – analyse impacts of post-harvest processing (transport, storage and distribution) on the availability of fresh seasonal foods	**Students know:** • **relationships between social attitudes and decisions** – social attitudes e.g. ethics, legality, production efficiency, sustainability, consumer health – decisions e.g. data, advocacy of interest groups, government policy, interest of shareholders • **applications of science in agriculture** – use of scientific products e.g. steroid implants – use of scientific procedures e.g. castration, permaculture – development of new products e.g. pest-resistant crops, genetically modified foods **Students:** • **analyse relationships** – select an application of science in agriculture – identify social attitudes related to an application held by different stakeholders – examine the impacts of different social attitudes on decisions made about the application e.g. analyse the social attitudes and decisions around the release of genetically modified organisms or use of antibiotics and hormones in plants and animals for food production	**Students know:** • **scientific concepts** e.g. permaculture, microbial testing, hydroponics • **cost and benefit evaluation strategies** – develop criteria to assess the costs/benefits of an application e.g. user requirements, efficiency, sustainability – identify possible sources and gather data e.g. trials, controls, laboratory experiments, field trials, secondary sources, interviews – analyse and evaluate the data in relation to the criteria – present findings in relation to the cost/benefit of an application **Students:** • **evaluate the costs and benefits of applications of science in agriculture** – evaluate the use of chemicals in farming e.g. the use of fertilisers and increasing problems of run-off and watercourse pollution by collecting data from agriculturalists and analysing this in terms of its environmental impacts and benefits – evaluate the environmental impact of farming practices e.g. conduct a trial on the effects of stocking rates on land condition and present recommendations based on the data

Agriculture and Society

SO 4.3 Students predict the impact of changes on environments by comparing evidence. (SOSE PS 4.2)	**SO 5.3** Students design strategies for evaluating environmental impacts of a proposed project, highlighting relationships within and between natural systems. (SOSE PS 5.2)	**SO 6.3** Students create proposals to resolve environmental issues in the Asia–Pacific region. (SOSE PS 6.2)
Students know: • **evidence** – reasons for field studies e.g. impacts of agricultural practices on the local environment; sustaining agricultural environments – land management strategies e.g. revegetation – animal management strategies e.g. containment of farm animals; sustainable populations – conservation and protection strategies e.g. installation of water-saving devices on irrigation systems; disposal of waste chemicals; role of legislation/regulations in protecting a place e.g. clear felling	**Students know:** • **strategies for evaluating environmental impacts** – geographical inquiry e.g. availability of water; weather patterns and climatic conditions; soil type; vegetation; land contour; location; primary and secondary resources – different global locations e.g. similarities and differences of physical attributes in different places – impacts of ecosystems on types of agriculture e.g. selection of farming method; cultivation or grazing; intensive or non-intensive; irrigation method	**Students know:** • **proposals about the environment** – research methodology and analysis include questions and identify problems e.g. What management systems or husbandry practices can be used to establish or maintain an agricultural environment? • **environmental issues** e.g. advantages and limitations of different husbandry practices
Students: • **compare evidence** – implement field study methods to gather and analyse the data e.g. keep a journal to record the occurrence of local species within the area and suggest ways of minimising the impacts of school agricultural practices on their populations – make recommendations about the most effective ways to care for a place e.g. monitor and record soil moisture levels to make recommendations about the use of irrigation in a vegetable plot	**Students:** • **design strategies to evaluate impact of a project** – develop a set of questions about agriculture in that ecosystem – analyse the patterns of similar ecosystems and some of their key features – identify impacts or consequences for sustainable agricultural land use and practice in that locality e.g. compare market gardening in south-east Queensland and New Guinea and describe the impacts of locality on agricultural places and practices	**Students:** • **resolve environmental issues** – identify a problem related to an aspect of the maintenance of an agricultural enterprise and use an action research process to improve this aspect e.g. use action research processes to optimise hydroponic systems for growing lettuces or herbs

Agriculture and Society

SO 4.4 Students investigate how agriculture in the local area contributes to the economy of the area.	**SO 5.4** Students analyse and explain the relationship between Australian agriculture and the Australian economy.	**SO 6.4** Students evaluate the economic potential of a range of local agricultural enterprises.
Students know: • **agriculture in the local area** – agricultural enterprises in the local area – secondary agribusinesses in the local area • **contribution to the local economy** – products produced and sold locally – products produced locally and sold outside the area – employment in agriculture or related industries – ways agriculture supports other businesses and institutions in the local area	**Students know:** • **Australian agriculture** – main agricultural enterprises in Australia • **relationship of agriculture to the economy** – contribution of agricultural industries to domestic and export markets – contribution of agriculture to employment (directly and indirectly) – major traditional agribusinesses and the new agribusinesses being developed in Australia e.g. organic foods, bush tucker – financial relationship between the agricultural industry and other Australian industries e.g. wool to the clothing industry	**Students know:** • **economic potential of local agricultural enterprises** – relevant factors e.g. product supply and image; stability and growth of markets; market development; government assistance; management structures; cost of production; seasonal availability; capital investment and growth – sources of data about the economic outlook of an agricultural enterprise e.g. primary producers, Department of Primary Industries and Fisheries, Australian Bureau of Statistics, Farmers Federation, share market
Students: • **investigate how agriculture in the local area contributes to the economy** – collect data about agricultural industries in the local area e.g. from the local library, business associations, government offices and the Department of Primary Industries and Fisheries office – describe how these industries contribute to the economy of the local area e.g. employment, sales, production – interview local people to gather information about the effects of agriculture on the local area	**Students:** • **analyse and explain the relationship between Australian agriculture and the Australian economy** – research an Australian agricultural or agribusiness industry e.g. dairy, olive, pig, beef, wine, wool, poultry, fruit, vegetable	**Students:** • **evaluate the economic potential** – develop and present a case for viability of an agricultural enterprise or agribusiness e.g. olives, barramundi farming, red claw farming – report on the economic outlook of a niche market e.g. a particular type of coffee, organic fruit and vegetables

Agricultural Mechanics and Construction

MC 4.1 Students explain the principles of engines used in agricultural enterprises.	**MC 5.1** Students demonstrate the operation of engines and procedures for engine maintenance.	**MC 6.1** Students disassemble engines, carry out simple repairs and reassemble.
Students know: • **engines used in agricultural enterprises** – two stroke – four stroke – diesel engines • **principles of engines** – parts of two stroke, four stroke and diesel engines – the working principles of two stroke, four stroke and diesel engines – ignition systems on petrol engines **Students:** • **explain the principles of engines** – investigate the sequence of actions within an internal combustion engine – inspect different parts of engines and investigate how they work – explain to others how internal combustion engines operate – use models and videos to gain an understanding of the workings of the internal combustion engine – construct diagrams and drawings of how engines work	**Students know:** • **operation of engines** – water- and air-cooling systems – injection systems and compression fuel ignition in diesel engines – internal lubrication engine principles • **procedures for maintenance of engines** – the lubrication and maintenance of engines and moving parts powered by engines **Students:** • **demonstrate their knowledge of engine operation and procedures for maintenance** – apply knowledge from engine manuals and service guides – construct diagrams of how engine parts work – explain the fuel, cooling, lubrication and electrical systems of engines to others – explain to others why lubrication and cooling are necessary components of an internal combustion engine – carry out correct maintenance procedures on a small internal combustion engine – operate engines e.g. pre-start checks, start and operate simple stationary engines	**Students know:** • **parts of engines** – carburettor – injection fuel systems – alternators – ignition systems and associated electrical systems of engines • **simple repair procedures** e.g. cleaning, adjustment and maintenance of spark plugs and fuel lines, filters **Students:** • **disassemble, repair and reassemble** – clean air filter – replace oil filter – change fuel pump – change spark plugs – pull off carburettor, disassemble, clean and reassemble – replace head gasket – adjust valve clearances

Agricultural Mechanics and Construction

MC 4.2 Students explain how characteristics of materials affect ways they can be manipulated. (Tech MAT 4.1)	**MC 5.2** Students compare and contrast materials according to their characteristics to determine how effectively the materials meet predetermined standards. (Tech MAT 5.1)	**MC 6.2** Students incorporate in their design proposals ideas about the impacts of particular materials used in products. (Tech MAT 6.1)
Students know: • **characteristics of materials** e.g. strength, flexibility, hardness, durability, appearance, resistance to weather conditions • **manipulation of materials** – characteristics of materials determine the ways they can be manipulated – techniques used to manipulate materials e.g. cut, shape, join **Students:** • **explain how characteristics of materials affect ways they can be manipulated** – describe the properties of materials – describe how the characteristics of a material will allow it to be manipulated e.g. the plasticity of acrylic will allow it to be moulded – test the suitability of tools on a range of materials – compare equipment that is made with different materials	**Students know:** • **how materials meet predetermined standards** – materials can be compared and contrasted according to their characteristics – how the characteristics of materials affect their performance – materials can be selected to meet standards e.g. accuracy **Students:** • **compare and contrast materials in relation to the standards** – identify the characteristics of materials that would meet the standards e.g. identify a corrosive-resistant material for use outdoors – compare the strengths and weaknesses of two or more materials in relation to the standards – compare the finished items to the specifications and criteria in the drawings/plans	**Students know:** • **impacts of particular materials** – impact on the environment e.g. pollution, depletion of resources – aesthetic qualities – final product – workplace health and safety issues of their use **Students:** • **incorporate in their design proposals ideas about the impacts of materials** – describe how consideration of the impacts have influenced their design proposal e.g. recyclable plastics chosen for a production – develop strategies to handle material waste effectively

Agricultural Mechanics and Construction

MC 4.3 Students employ their own and others' practical knowledge about equipment and techniques for manipulating and processing materials in order to enhance their products. (Tech MAT 4.2)	**MC 5.3** Students operate equipment and apply techniques for manipulating and processing materials to meet predetermined standards. (Tech MAT 5.2)	**MC 6.3** Students use specialised equipment and refined techniques to make quality products to detailed specifications. (Tech MAT 6.2)
Students know: • **equipment to manipulate materials** – considerations when selecting equipment e.g. knowledge of equipment, access to equipment, ease of use, appropriate equipment for the technique • **techniques to manipulate materials** – considerations when selecting techniques e.g. technique matches the purpose, time available, personal skill level, characteristics of materials **Students:** • **employ their own and others' practical knowledge** e.g. consult with farmer, industry personnel or teacher to develop a watering system for the school garden • **enhance their products by manipulating and processing materials** e.g. calculate the exact amount of fertiliser when adding it to a hydroponic system	**Students know:** • **equipment to manipulate materials** – suitability of different equipment to meet predetermined standards – safe work practices when operating equipment • **techniques to manipulate materials** – suitability of different techniques to meet predetermined standards – safe work practices when applying techniques **Students:** • **operate equipment and apply techniques to meet standards** – work safely, accurately, efficiently – incorporate predetermined standards when manipulating materials with precision	**Students know:** • **specialised equipment** – a range of specialised equipment – effects that can be achieved using specialised equipment e.g. a CNC lathe • **refined techniques** – effects that can be achieved by refined techniques e.g. copy attachment for a wood lathe **Students:** • **use specialised equipment and refined techniques** – select the techniques and equipment that match detailed specifications

Agricultural Mechanics and Construction

MC 4.4 Students propose ways of responding to situations and behaviours that are unsafe, harmful or risky, after assessing options and consequences. (HPE PH 4.3)	**MC 5.4** Students demonstrate behaviours and actions to provide care or manage risk in responding to unsafe or risky situations and behaviours. (HPE PH 5.3)	**MC 6.4** Students devise personal and community strategies to respond to potentially unsafe situations and behaviours. (HPE PH 6.3)
Students know: • **unsafe, harmful or risky situations and behaviours** e.g. risks, hazards and dangers associated with tools, equipment, machinery, chemicals, animals, communicable agricultural diseases, meanings of safety and warning signs used in agricultural situations	**Students know:** • **behaviours and actions that provide care** – first aid procedures – management procedures for emergency situations – management procedures for handling animals and using chemicals e.g. signs, warning labels – procedures for operating agricultural equipment and simple machinery • **behaviours and actions that manage risk** – seek assistance or advice – identify and assess risks or hazards to self and others – devise action plans and implement ways to minimise risks – recognise personal limitations – follow legislation/codes of practice	**Students know:** • **personal strategies** – risk assessment – how to be assertive – first aid procedures – strategies to prevent or minimise risks – equipment and skills for activities – how to seek qualified instruction • **community strategies** – education campaigns e.g. Farm Safe – workplace health and safety – advocacy
Students: • **propose ways of responding** – describe safe working practices in agricultural situations – develop a poster to promote safe behaviour in agricultural situations – identify safety issues associated with tools, machinery or materials before using them – carry out a risk assessment	**Students:** • **demonstrate behaviours and actions to provide care or manage risk** – determine a list of dangerous instances or situations where they would need to seek assistance or advice from others – determine a list of dangerous instances or situations and the specific risks associated with each situation – work in groups to discuss the risks associated with specific farm activities or machinery and develop codes of safe practice for dealing with these situations – develop a checklist for safe behaviour and conduct peer assessment of safe practices using the checklist – complete online safety modules e.g. Queensland Department of Industrial Relations modules	**Students:** • **devise personal and community strategies to respond to potentially unsafe situations and behaviours** – read, reflect on and discuss information from Department of Primary Industries and Fisheries about accident statistics on farms – survey local farms and agribusinesses to determine the effectiveness of workplace health and safety strategies in place and develop strategies to improve practice – collect data/articles regarding rural/farm accidents and develop a campaign in response to identified concerns – read the instruction manuals, particularly the safety section, of all the machinery and equipment in the school – develop a card index on safety for all the equipment used on the school farm

Agricultural Mechanics and Construction

MC 4.5 Students use technology practice (as described in the Level 4 core learning outcomes in the *Years 1 to 10 Technology Syllabus*) to promote effective agricultural production.	**MC 5.5** Students use technology practice (as described in the Level 5 core learning outcomes in the *Years 1 to 10 Technology Syllabus*) to promote effective agricultural production.	**MC 6.5** Students use technology practice (as described in the Level 6 core learning outcomes in the *Years 1 to 10 Technology Syllabus*) to promote effective agricultural production.
The learning outcomes from the Technology Practice strand of the *Years 1 to 10 Technology Syllabus* are reproduced below. These are to be used as a set.		
Students use consultative methods to gather knowledge, ideas and data when researching alternatives within design challenges. (Tech TP 4.1)	Students analyse links between the knowledge, ideas and data gathered to meet design challenges and the design and development of new and improved products. (Tech TP 5.1)	Students formulate detailed plans for gathering knowledge, ideas and data and validate choices of information, sources and methods. (Tech TP 6.1)
Students know: • **consultative methods** e.g. interviews, surveys, discussions, focus groups, questionnaires, online community discussions, teleconferences, meetings, professional advice • **alternatives within design challenges** – ideas, options – advantages and disadvantages of particular ideas and options	**Students know:** • **links between information gathered and the design and development of products** – knowledge, ideas and data inform development of products e.g. data about potential users – new materials, products or techniques – ways of developing products to meet new or emerging needs • **ways to analyse links between information gathered and the development of products** – identify the knowledge, ideas and data that are reflected in the design and development of products, and those that are not reflected – consider how well the product design and development match the knowledge, ideas and data gathered e.g. conduct SWOT and PMI analyses	**Students know:** • **detailed plans for gathering knowledge, ideas and data** – information from a range of sources enhances accuracy and reliability – detailed plans may identify possible sources of information, methods of collecting data and timelines for gathering information • **ways to validate choices of information, sources and methods used to gather information** – consult experts about the validity of and the methods used e.g. ask workers in agricultural workshops about how they undertake their market research – investigate the reliability of the source e.g. Who has produced the data? What qualifications does the group hold? – cross-reference with information gathered from other sources
Students: • **use consultative methods** – gather information using various methods e.g. talk to people working on a farm or agribusiness to determine how the equipment they use meets their needs; observe the design of equipment they could construct later – use resources that specialists have developed to gather information e.g. internet, email or online communities, brochures, journals • **research alternatives within design challenges** – analyse and compare ideas and information gathered through consultation e.g. for gates, cattle crushes or brooders of different design and construction	**Students:** • **analyse the links between information and the development of products** – analyse how information about the users' needs influences the development of new products e.g. planters that combine fertiliser with seeds, poultry feeders that don't waste food – survey groups of people to determine their needs and wants e.g. define a range of products that could be provided by the school's agricultural section – consult with people who design products to discover how their knowledge of the needs of the community affects their design work e.g. sheet-metal workers, engineers	**Students:** • **formulate detailed plans for gathering knowledge, ideas and data** – develop an action plan by identifying sources, collection methods, timelines • **validate choices, sources and methods** – evaluate the sources of data and the relevance to the design challenge – identify constraints that impact on the choice of sources and methods e.g. time, cost – provide evidence that the information is accurate, current and from a respected source

Agricultural Mechanics and Construction

Students generate design ideas through consultation and communicate these in detailed design proposals. (Tech TP 4.2)	Students generate design ideas and communicate these in design proposals that indicate an understanding of factors influencing production of the option(s) they have selected. (Tech TP 5.2)	Students generate design ideas and communicate these in design proposals that indicate various options and incorporate management strategies. (Tech TP 6.2)
Students know: • **strategies that lead to the generation of design ideas** e.g. brainstorming, negotiations, discussions, gathering opinions about design proposals • **detailed design proposals** – communicate design ideas – provide background information about the design challenge, product purpose, intended users – show considerations of resources, timelines, product specifications, production procedures • **ways to communicate design ideas** e.g. annotated diagrams, written descriptions, models, prototypes, sketches, scale drawings	**Students know:** • **factors influencing the production of selected options** – human and physical resources e.g. knowledge, time, skills, equipment – considerations of appropriateness e.g. environment, function, culture, social impact – economic factors e.g. cost, sustainability	**Students know:** • **options within design proposals** – resources – production techniques • **management strategies** – strategies to manage resources e.g. people, time, materials, equipment
Students: • **generate design ideas through consultation** – consult with others to develop and refine ideas e.g. with a farmer for grain or root crop, or small animal, enterprises – consult with the teacher or other students to discuss alternative design proposals e.g. for an agricultural artefact or enterprise – visit experts to discuss how they plan and design their projects e.g. how a farmer plans and designs a new orchard irrigation, pig pen, cattle crush, egg laying house, egg box, gate • **communicate design ideas in detailed design proposals** – select and use appropriate ways to communicate the details of design proposals – use annotated sketches to communicate ideas for a product	**Students:** • **generate and select design ideas** – devise a range of options – analyse ideas and select the preferred options using strategies e.g. SWOT and PMI analyses – record consultations with clients/users to confirm that design ideas reflect needs and wants – identify impacts and consequences of different ideas – keep anecdotal records and notes of discussions – explain why a design idea was accepted or rejected • **communicate design proposals** – develop written proposals, oral presentations, diagrams, visual presentations, folios – develop sketches, flow charts, drawings, plans, procedures – describe the materials required; methods of production or implementation; sequence of action – use correct and suitable symbols, graphics and language for the intended audience	**Students:** • **incorporate management strategies** – plan to minimise waste – prepare budgets – develop workable timelines by consulting team members – observe and refine workplace procedures – minimise negative impacts of particular practices e.g. negative impacts on the environment – formulate checklists to ensure that the processes used are appropriate e.g. workplace health and safety

Agricultural Mechanics and Construction

Students identify and make use of the practical expertise of others when following production procedures to make products for specific users. (Tech TP 4.3)	Students meet predetermined standards as they follow production procedures to make quality products. (Tech TP 5.3)	Students negotiate and refine production procedures in making quality products that meet detailed specifications. (Tech TP 6.3)
Students know: • **practical expertise of others** – people with specialised knowledge or equipment – research techniques – documentation of the designs and processes of others • **specific users** – identified individuals or groups for whom the product will meet a need/desire – demographic description of a target group by features such as age, gender, occupation	**Students know:** • **predetermined standards** – design briefs or proposals – client specifications – government standards – industrial and commercial standards of quality and performance – desired effects e.g. optimise efficiency, productivity, performance	**Students know:** • **reasons to negotiate and refine production procedures** – minimise waste – enhance product quality – meet timelines and budget requirements – accommodate unforeseen circumstances • **ways to negotiate and refine production procedures** – team consultation and feedback – trials of production procedures – timelines for production – processes that streamline the production – production can be systematised by breaking it into stages – products may be modified to allow different or more simple methods of manufacture
Students: • **identify and make use of practical expertise of others** – identify individuals and groups in the community with expertise – consult people with practical expertise – seek assistance from experts about procedures – observe experts at work – engage mentors for skill development – request feedback and advice • **follow production procedures to make products for specific users** – follow production procedures as detailed in the design proposals e.g. grow crops or raise animals as class projects, develop hydroponic enterprises, construct guinea pig cages – integrate points for feedback from users – organise market research/test groups – meet product specifications as detailed in the design proposals	**Students:** • **follow production procedures** – implement design and production steps – manage resources within constraints e.g. finances, equipment, time • **make quality products that meet predetermined standards** – identify the predetermined standards or client specifications e.g. functionality, cost effectiveness – monitor procedures to reflect standards and modify procedures if required – create aesthetic appeal e.g. finishes such as galvanised, powder-coated, anodised, painted	**Students:** • **negotiate and refine production procedures** – consult and negotiate with others to refine production procedures in progress e.g. feed the pigs on the school farm for a time before refining the pig feeder – identify and implement alternative production procedures to solve problems as the plan is implemented e.g. cutting all materials before assembly or cutting as assembly proceeds • **make quality products that meet detailed specifications** – identify the specifications required in design proposals – implement production procedures to meet these specifications – achieve accuracy, quality

Agricultural Mechanics and Construction

Students gather feedback to gauge how well their design ideas and processes meet design challenges and how effectively products meet the needs of specific users. (Tech TP 4.4)	Students use predetermined criteria to judge how well processes and products meet the needs of specific users, and recommend modifications or improvements. (Tech TP 5.4)	Students identify methods for evaluating commercial or industrial products and processes and use these to judge the appropriateness of their own processes and products. (Tech TP 6.4)
Students know: • **how to gather feedback** e.g. simple surveys, interviews, product comparisons, people's reactions to a product, team members' critiques, self-reflection, observations • **how to develop tools for gathering and interpreting feedback** – open or closed questions – compilation and interpretation of data – collate data and identify key messages e.g. record data in tables, calculate percentages, graph data **Students:** • **gather feedback about design ideas, processes or products** – develop a list of criteria to measure the effectiveness of their design e.g. cost of production, quality of the product or enterprise, conditions of production, profitability, management of resources – gauge how well design ideas, processes and products meet design challenges – gauge how effectively products meet the needs of specific users – analyse if resources could have been better invested in a different enterprise – survey the rest of the class, or another class, about the success or otherwise of the enterprise or product – write a brief report comparing the final product or the outcome of the enterprise with the plan	**Students know:** • **how to use predetermined criteria to modify or improve processes and products** – strengths and weaknesses of a process or product in relation to the criteria – recommendations for change on the basis of the criteria – similarities and differences between the design ideas and the final processes and production – determining how well users' needs are met **Students:** • **use predetermined criteria** – identify the criteria – use criteria established by the teacher or others – generate criteria to test their processes, products or services – devise criteria for the purpose of judging and improving documentation – devise criteria for improving production methods and product performance • **judge how well the processes or products match the criteria** – rate the product – describe strengths and weaknesses of processes – carry out product tests – conduct market research – consider a range of ways to evaluate their designs and recognise that the most appropriate design depends on the criteria used to develop the design • **use judgments to make recommendations for changes** – modify a part of a process that could be strengthened	**Students know:** • **methods for evaluating commercial or industrial products and processes** – product tests and trials – interviews with users – market research e.g. telemarketing, surveys, focus groups – consultations with experts – independent evaluations **Students:** • **identify methods for evaluating** – select and use methods e.g. for reliability, feasibility – validate methods for evaluating their own products and processes • **make judgments about the appropriateness of their own processes and products using data gathered** – decide if the processes for conceptualising and making the products have achieved the goal – analyse the data collected during evaluations and draw conclusions about the success of the products – make judgments in devising evaluation criteria in relation to aesthetics, culture, economics, environment, ethics, function, society – ask advice from experts, parents/carers, teachers about documentation, production methods and product performance – compare their documentation, production methods or product performances to those of commercial companies – use their own criteria to evaluate commercial companies' documentation, production methods and product performance

Appendix 1

Technology Practice: Learning outcomes

Technology Practice: Learning outcomes

(Excerpt from the *Years 1 to 10 Technology Syllabus*)

*L*earning outcomes

Technology Practice

Investigation is carried out to gather knowledge, ideas and data for use in meeting design challenges.

Ideation is undertaken to generate and communicate ideas that meet design challenges, and to justify the selection of these ideas.

Production procedures can be identified, described and managed when making products that meet design challenges.

Evaluation is undertaken to make judgments about the appropriateness of design ideas, processes and products when meeting design challenges.

Level 4	Level 5
Level statement *Students consult others when gathering information, generating design ideas and developing detailed design proposals. They make use of the practical expertise of others when following production procedures to make products. Students gather feedback to evaluate their ideas, processes and products.*	**Level statement** *Students analyse the links that exist between information gathered and the design and development of products. They develop design proposals that show an understanding of factors influencing the production of their products. Students use predetermined criteria to evaluate their processes and products.*
Core learning outcomes	**Core learning outcomes**
TP 4.1 Students use consultative methods to gather knowledge, ideas and data when researching alternatives within design challenges.	**TP 5.1** Students analyse links between the knowledge, ideas and data gathered to meet design challenges and the design and development of new and improved products.
TP 4.2 Students generate design ideas through consultation and communicate these in detailed design proposals.	**TP 5.2** Students generate ideas and communicate these in design proposals that indicate an understanding of factors influencing production of the option(s) they have selected.
TP 4.3 Students identify and make use of the practical expertise of others when following production procedures to make products for specific users.	**TP 5.3** Students meet predetermined standards as they follow production procedures to make quality products.
TP 4.4 Students gather feedback to gauge how well their design ideas and processes meet design challenges and how effectively products meet the needs of specific users.	**TP 5.4** Students use predetermined criteria to judge how well processes and products meet the needs of specific users, and recommend modifications or improvements.

*L*earning outcomes

Technology Practice

Investigation is carried out to gather knowledge, ideas and data for use in meeting design challenges.

Ideation is undertaken to generate and communicate ideas that meet design challenges, and to justify the selection of these ideas.

Production procedures can be identified, described and managed when making products that meet design challenges.

Evaluation is undertaken to make judgments about the appropriateness of design ideas, processes and products when meeting design challenges.

Level 6	Beyond Level 6
Level statement *Students prepare detailed plans for gathering information and validate their sources and methods. They develop various design proposals that incorporate strategies for managing resources and make quality products that meet detailed specifications. Students use methods that reflect commercial and industrial standards to evaluate their processes and products.*	**Level statement** *Students analyse information in detail and develop understandings and ideas that can lead to innovative and enterprising ways of meeting design challenges. They develop detailed proposals, manage production procedures that reflect industrial and commercial standards and make innovative products. Students use a range of methods to make judgments about the feasibility and community acceptance of their processes and products.*
Core learning outcomes	**Discretionary learning outcomes**
TP 6.1 Students formulate detailed plans for gathering knowledge, ideas and data and validate choices of information, sources and methods.	**TP B6.1** Students develop formal analyses of knowledge, ideas and data to meet design challenges in innovative and enterprising ways.
TP 6.2 Students generate design ideas and communicate these in design proposals that indicate various options and incorporate management strategies.	**TP B6.2** Students generate design ideas and communicate these in detailed design proposals that show evidence of innovation and include in-depth analysis of appropriateness.
TP 6.3 Students negotiate and refine production procedures in making quality products that meet detailed specifications.	**TP B6.3** Students manage production procedures that reflect commercial or industrial standards in order to make innovative products.
TP 6.4 Students identify methods for evaluating commercial or industrial products and processes and use these to judge the appropriateness of their own processes and products.	**TP B6.4** Students use a range of methods to judge whether their design ideas, production procedures and products are commercially or industrially feasible, and acceptable to the community.

Appendix 2

Technology Practice: Core content

Technology Practice: Core content

(Excerpt from the *Years 1 to 10 Technology Syllabus*)

Core content

Technology Practice

Investigation — gathering knowledge, ideas and data to meet design challenges

- analysis of design challenges
  - identifying needs, wants and opportunities (observing, consulting, conducting needs analyses or environmental scans)
  - identifying design requirements (user requirements, safety requirements, requirements under relevant legislation, regulations or conventions)
  - identifying design constraints
- sources of knowledge, ideas and data (familiar and unfamiliar)
  - environments
  - products of technology
  - internet (websites and online communities)
  - people (potential users, clients, specialists and experts)
  - libraries
- methods of gathering knowledge, ideas and data
  - consulting (questioning, questionnaires, surveys, interviews)
  - exploring, examining
  - researching
  - observing, scanning
  - experimenting, testing
- methods of organising and analysing knowledge, ideas and data
  - recording
  - selecting, sorting and comparing
  - interpreting, inferring and concluding
  - identifying alternatives
  - validating choices
  - challenging ideas
  - verifying accuracy
  - establishing relevance

Ideation — generating and communicating ideas that meet design challenges

- generation of ideas to meet design challenges
  - generating new ideas
  - modifying and refining designs
  - selecting and justifying design options
  - identifying materials, information and systems to meet design requirements
  - identifying equipment and techniques
- communication of ideas that meet design challenges
  - pictures, sketches, annotated drawings
  - play, roleplay
  - drawings of different views
  - scale drawings
  - computer-aided design (CAD)
  - models
  - technical terms
  - design proposals and specifications
  - detailed plans
  - oral, written and multimedia presentations

Production — making products to meet design challenges

- production procedures
  - developed (independently and cooperatively)
  - informed by practical experience
  - described, negotiated, refined
  - standards specified
  - identified, sequenced, followed
  - managed
- products (artefacts, processes, systems, services and environments)
  - meet human needs or wants
  - capitalise on opportunities
  - extend human capabilities
  - make models and prototypes
  - meet standards (predetermined criteria, commercial or industrial standards)

Evaluation — judging the appropriateness of design ideas, processes and products when meeting design challenges

- evaluation of design ideas, processes and products
  - expressing thoughts and opinions
  - gaining feedback from others (clients, specific users)
  - testing and judging effectiveness in real-life or lifelike contexts
  - comparing initial design ideas and final products
  - applying standards (predetermined criteria, commercial or industrial standards)
  - evaluating management decisions

Impacts and consequences

- historical, current and future developments
- impacts and consequences related to aesthetic, cultural, economic, environmental, ethical, functional and social appropriateness
- effects of management decisions

Copyright notice