TECHNOLOGICAL CONTEXT KNOWLEDGE AND SKILLS

Exploring specific knowledge and skills to support programmes in technology

MATERIALS FOR CONSULTATION TO SUPPORT MINISTRY DECISION MAKING

Introduction

The learning area of Technology was reviewed as part of *The New Zealand Curriculum* in 2007. The curriculum presents the generic aspects of technology education for teachers and students, that is, the concepts and practices common across all learning contexts in technology. These concepts and practices are grouped into 3 strands and 8 components. The curriculum and the curriculum support material on Techlink emphasise the need for teaching and learning programmes to develop specific learning experiences for students in Technology that reflect *both* the curriculum components *and* additional context specific knowledge and skills.

It is important for students to develop context specific knowledge and skills and be able to apply these appropriately in a given scenario. A scenario, as defined here, is a specific learning situation that supports students to apply knowledge and skills when focussed on a particular task designed for this purpose. 'Working in scenario' will allow students to gain experience in applying a broad set of knowledge and skills. These knowledge, skills and application experiences will then provide students with a strong base from which to make decisions within their own technological practice, and to help them develop the generic understandings that underpin the nature of technology and technological knowledge strands.

Context specific knowledge and skills can enhance student achievement across all components of technology, and particularly the quality of any technological outcome developed through the component of outcome development and evaluation. Providing guidance for how these may be taught, and allowing opportunity for some of these key specific knowledge and skills to be validated, is therefore important for the development of senior secondary technology programmes and for qualification purposes.

The Current Project

Context specific knowledge and skills have always been an integral part of technology education. Two key questions consistently asked by the sector are; how are knowledge and skills developed in technology programmes, and how are these properly validated for the purposes of national qualifications?

The current *technological context knowledge and skills* (TCKS) project seeks to recognise the way in which specific knowledge and skill development supports generic understandings and practices in technology and how generic understandings and practices provide a broader purpose for the development of specific knowledge and skills.

The material included below is NOT an attempt to rewrite the technology learning area or an alternative to the generic components of technology. These aspects are complementary and are both seen as essential for the development of technological literacy.

The purpose of this consultation document is to gain sector feedback for the exploration of technological context knowledge and skills in technology programmes. The material below is the result of the TCKS project, where groups of teachers, industry and tertiary representatives were asked to articulate context specific knowledge and skills appropriate to their areas of expertise

and make decisions as to which of these were 'key' to support coherent technology programmes of learning for students. This process also involved providing examples of what students could do at each level as well as potential teaching foci.

Key context specific knowledge and skills[1] are deemed to be those that:

- most programmes would expect to explore in the particular context;

and/or

- most students need to have an understanding of and ability in, in order to progress to more involved and complex practices when working in this context.

The final version of this material will form the basis for two subsequent projects:

1. The development of the Technology Teaching and Learning Guides, and
2. The development of context specific knowledge and skill achievement standards[2] for technology.

Structure of the Consultation Material

The draft material has been structured under 'context' headings for the purpose of gaining feedback.

Each context contains:

- the overall objectives considered important by the writers;
- indicators of progression for these at levels 6, 7 and 8 of the curriculum (levels 1, 2 and 3 of the National Qualifications Framework); and
- some examples of what could be expected of students, or representative examples of what is meant by a statement of curriculum level.

It is important to note that where examples are used they are given as illustrative examples and ***NOT*** as an exhaustive list.

There are a number of aspects of this work that are still being worked on and will require additional time. Some will be addressed as a result of the feedback to this material and other aspects have already been identified and will be further developed shortly. Those aspects that have been identified to date as potentially needing further guidance and assessment tools include:

- Production and process
- Packaging and labelling
- Intellectual property
- Design

These aspects are not contexts as such, but rather have additional knowledge and skills associated with them that are particularly applicable to technology **should** they become a focus within any context.

Material will be presented on Techlink regularly for comment and development. *When any new teaching and learning guides and achievement standards are developed there will be additional opportunities for consultation and feedback.*

[1] In senior secondary, 'skills' are more accurately described as techniques in that they are a collection of smaller skills applied in knowledgeable fashion.

[2] To meet ministry requirements, final learning objectives must be consistent with levels 6, 7 and 8 of the New Zealand Curriculum. Resulting achievement standards must align with these objectives and meet all consistency requirements for NCEA curriculum based standards.

Supporting Pathways to Tertiary and Industry

The purpose of schooling is to educate students for future employment, study and engagement with their community. For technology education this means supporting students' technological literacy to the point where they exit schooling. For most students exit points begin after completion of year 11. Those entering industry related training or technology related tertiary courses will generally seek to build an increasingly specific set of skills and knowledge across a range of learning areas (notably science and mathematics).

It is of vital importance that technology programmes in secondary schools support as many pathways as resources and student aspiration allow. Regardless of which pathway students select, technology education provides an important way of viewing and interacting in the world that informs all students as future citizens.

Feedback

The Ministry is seeking feedback from any interested party on the development of technological knowledge and skills. Feedback can be made to the contact below or via the feedback page on Techlink.

1. Do these contexts reflect current teaching and learning programmes and/or support future programme developments? If not, what contexts should be added or removed from the draft material?
2. Are these the 'key' knowledge and skills appropriate for the identified contexts for technology education programmes in New Zealand secondary schools? If not what knowledge and skills should be added or removed from the draft material?
3. Do the levelled indicators and their examples seem appropriate for programmes at curriculum levels 6, 7 and 8?
4. How well do the key knowledge and skills described support students to transition into employment, industry related training or tertiary study at appropriate levels?
5. Would you like to be contacted directly when further material is developed for consultation? If so please provide a name and email contact.

Please send responses to this paper and the questions above to feedback@teched.net.nz by **4 pm 25 August 2009.**

For any general enquiries about technology education please contact
Niall Dinning, National Coordinator Technology Education, 07 333 1551, niall@teched.net.nz.

Key to detail of *Technological Context Knowledge and Skills: Objectives and Indicators*

CONTEXT

Objective

- [L6] Curriculum level indicator
    - Further explanation
        - examples

Technological Context Knowledge and Skills: *Objectives and Indicators*

DIGITAL TECHNOLOGIES

DIGITAL INFORMATION

Demonstrate an understanding of the role of digital tools and systems for managing information.

- [L6] Identify the role of digital tools and systems for managing information
    - The fundamental concepts of common software applications such as a word processor, spreadsheet, database, desk top publishing. [Note: students will be expected to have a reasonable level of digital literacy by year 11, and this will build on that background]
- [L7] Be able to understand how data organisation tools and systems are integrated to manage complex information
    - For example:
        - Web 2.0 tools
        - Mail merge using spreadsheets and/or database with word processed document
        - Common applications integrated into an electronic presentation
- [L8] Demonstrate an appreciation of the field of information management and systems
    - Knowing about the discipline of information management and systems
    - Role of information systems in a functioning organisation system
    - Management structures

Be able to use digital tools to design and construct systems to manage information for a specific purpose

- [L6] Be able to competently, efficiently and responsibly use digital systems and tools to manage information
    - Includes:
        - Appropriate document layout
        - Formatting techniques
        - File management
- [L7] Be able to understand data organisation and management to design and construct systems for a specific purpose
    - For example:
        - Common database models consisting of two related tables
        - Data integrity techniques
        - Templates
        - Logical operators and functions
        - Databases and web pages
        - Integrated digital information
        - Handle complex data
- [L8] Be able to analyse, construct and develop integrated systems to manage information for a specific purpose
    - For example:
        - Relational Databases
        - Webservers
        - Prediction and analysis using spreadsheets
        - Creating styles and Table of Contents
        - On-screen forms

- Macros
- Managing multiple worksheets
- Managing long documents
- SQL

DIGITAL INFRASTRUCTURE

Demonstrate an understanding of digital infrastructure: hardware, software, networks, and their components

- [L6] Demonstrate an understanding of the function of common individual components of digital infrastructures
    - Know the purpose and key characteristics of desktop computer components [PSU, motherboard, CPU, storage etc.]
    - Know the purpose and key characteristics of simple storage devices [disks - magnetic and optical, solid state - RAM, flash etc.]
    - Know the purpose and key characteristics of network components for a LAN [NIC, routers, cabling etc.]
    - Know the purpose and key characteristics of system software [printer drivers, virus checkers, disk defrag, etc.]
- [L7] Demonstrate an understanding of how the components of a digital infrastructure are connected and interact.
    - Understand the role of operating systems and their features that relate to configuration of components and networks (major operating systems including command-line systems, automatic configuration, drivers)
    - Understand the characteristics of the physical connections of hardware components [e.g. buses, SATA, ethernet]
    - Understand the role of common network and communication protocols and standards for desktop systems and local area networks [such as TCP/IP, DHCP, subnet masks, LAN technologies, USB, wireless]
- [L8] Demonstrate a broad understanding of the structure and functioning of digital infrastructures, from personal systems to wide area networks
    - Know the purpose and key characteristics of large-scale networks [e.g. internet, public wireless networks, phone networks] and a range of specialist devices [e.g. portable devices such as cellphones, PDAs, MP3 players, digital cameras etc. as they are used to connect to or transfer files from networks.]
    - Understand the purpose of common network protocols, components and standards [e.g. TCP/IP, DHCP, subnet masks, OSI 7-layer model, LAN and WAN technologies, wireless systems, bluetooth, DNS, ISP], and advanced storage systems [e.g. SAN, RAID].
    - Understand the purpose of virtualisation, emulation and cloud computing
    - Understand security issues in networks
    - Be aware of trends in computing, and the purpose, and limitations of hardware components, storage and network technologies, operating systems, and peripherals
    - Understand issues surrounding upgrading and disposing of computing equipment [including increasing storage, upgrade vs. replace, and environmental issues with disposing of equipment]

Be able to design, and evaluate the performance of, a digital infrastructure

- [L6] Be able to choose components for a desktop computer for a specified purpose

- Choose components [e.g. memory capacity, graphics cards, peripherals] to have sufficient capacity to meet the needs of specified software
- [L7] Be able to choose the components and parameters for a local area network for a specified purpose
  - Choose network components and their parameters [e.g. LAN speed, routers/switches] to have sufficient capacity for a specified purpose [such as file sharing, file storage, shared services].
- [L8] Be able to choose the components and topology of a network of computers and their access to a Wide Area Network
  - Estimate the capacity of a design for a network of computers and their access to a Wide Area Network. [note: for example, estimate how many simultaneous streaming video feeds a network could support, or estimate the number of minutes of music that could be stored on a file system]

Be able to build, configure and maintain digital hardware and networks, including installing software

- [L6] Be able to install and configure hardware components, software and peripherals for a desktop computer
  - Installing software, hardware [e.g. disks, memory, video cards and drivers], and peripherals [e.g. webcams, printers]
- [L7] Be able to install, configure and maintain hardware, software and networking components for a small Local Area Network
  - Installing switches/routers [to the level of making minor parameter settings for a router]
  - Configuring a server (print/file)
  - Configure and maintain a small LAN to support given policies [e.g. file access, backup, user accounts – this would typically be on a dummy network]
- [L8] Be able to install, configure and maintain hardware components, software and networking components for a network of computers and their access to a Wide Area Network
  - Install software on a server [e.g. application server, web server, mail server]
  - Able to install and configure firewalls
  - Solve problems and maintain a computer/network/system, including providing help desk services to users. [e.g. resolving (fault finding and troubleshooting), documenting problems and communicating with users]

DIGITAL MEDIA

Demonstrate an understanding of the types of digital media, and how they are created.

- [L6] Identify digital media types and describe their distinguishing characteristics
  - Understand the purpose of digital media tools including but not restricted to:
    - Video production,
    - Audio production,
    - Layout and design,
    - Graphics and images,
    - Animation and modelling,
    - Interactive media (eg. game design).
    - Web development and design.

- [L7] Understand characteristics of digital media types and explain what they can be used for.
    - Understand the need for standards compliant technology e.g.:
        - layout conventions,
        - mark-up language,
        - w3 consortium,
        - tags,
        - accessibility standards.
    - Understand the importance of effective and appropriate file management procedures.
- [L8] Understand the underlying standards and structures of digital media types. Depending on the digital media:
    - Investigate and identify a variety of content management systems for developing and maintaining websites
    - Awareness of the digital tools /technologies of static, 2D and 3D graphics

Be able to create and publish a quality digital media product using appropriate media tools.

- [L6] Be able to confidently, efficiently and responsibly use digital media tools to create a quality digital media outcome.
    - Demonstrate technical expertise with digital media tools [at this level, expertise will be the measure of quality]
    - Can apply an understanding of digital media to design and create a number of different outcomes using a variety of digital media technologies.
    - Can interpret the needs of a situation to publish a successful and appropriate digital media outcome
    - The digital media is introduced and explored in a variety of virtual situations.
- [L7] Be able to use digital tools and techniques appropriate to the medium to create and publish a quality media project
    - Can identify and apply the appropriate file management techniques required to successfully publish digital media content.
    - Can input and manipulate and test digital media data to comply with current web standards or other digital media compliance requirements.
    - Can apply the appropriate processes for media input, editing and publishing.
    - The digital media can be used for a virtual solution or an incomplete real new or existing solution.
- [L8] Be able to integrate multiple digital media types to publish a quality digital media product in a suitable output format. Depending on the digital media:
    - Can effectively separate content and styling features
    - Can publish digital media in an appropriate format for the purpose
    - Can install and manipulate webserver based digital media and the associated server side functionality and requirements.
    - Can apply and test digital media to ensure that it is standards compliant.
    - The digital media is real and can be practically applied to a new or existing situation.

ELECTRONICS

Demonstrate an understanding of the devices, concepts and standards underlying the design and construction of electronic and embedded software systems.

- [L6] Demonstrate an understanding of simple concepts and devices

- Simple Concepts:
  - Conductors & insulators
  - Concept of Circuit
  - Voltage, Current, Resistance
  - Circuit and component symbols
  - Simple schematics
  - Input, process and output
  - Programming language
  - System design given scenario
- Simple Devices-
  - Recognition of and function of:
    - Simple components (e.g. battery, switch, resistor, LED etc)
    - Simple systems (voltage divider, transistor switch)
    - 'Kitset micros' e.g. lego, fisher-technic or simple PICAXE

- [L7] Demonstrate an understanding of concepts and devices
  - Concepts:
    - Power and heat dissipation
    - n- and p-type semiconductor
    - Time constant
    - Schematics & layout diagrams Binary notation
    - Amplification
    - Truth tables
    - Programme structure e.g. flow-charting
    - Variables (analogue and digital)
    - System design given scenario
  - Devices-
    - Component function in situ (resistor, capacitor)
      - *Note: a component may differ in its function depending on how it is used in a circuit*
    - Sensors/transducers
    - Simple microcontrollers e.g. PICAXE
- [L8] Demonstrate an understanding of more complex concepts and devices
  - More Complex Concepts:
    - Conduction in semiconductor components (diode, npn transistor, LED)
    - Signal processing (amplification, filtering)
    - I2C and RS232
    - Boolean logic (gates)
    - Subroutines
    - Macros
    - System design given scenario
  - More Complex Devices-
    - 555 in astable and monostable mode
    - Opamps as inverting and noninverting amplifier
    - Opamp as a comparator
    - Component function in situ (diode, transistor)
    - Microcontrollers e.g PICAXE, Atmel, Microchi

Be able to assemble, program, test, debug and modify electronic and embedded software systems

- [L6] Be able to assemble, program, test, debug and modify simple electronic and embedded software systems
    - Simple systems:
        - Projects involving basic components, sensors and a microcontroller
    - Project complexity:
        - Simple programme based on basic commands and supplied programme structures
            - typically characterized by simple sequences, system responding to only one input at a time, fixed time delays, on or off states
        - e.g. barrier arm- detect vehicle, push button, arm lifts, delay, motor reverses, arm drops, motor turns off.
- [L7] Be able to assemble, program, test, debug and modify electronic and embedded software systems
    - Systems:
        - Projects involving components, sensors and a microcontroller
    - Project complexity:
        - Programme will employ modified programme structures increased range of commands, stored variables, at least one subroutine
            - may include multiple sensors and the system may have to respond to combinations of sensor states
        - e.g. dual elevator, two floors, four call buttons, call discrimination, motors on/off and reverse
- [L8] Be able to assemble, program, test, debug and modify more complex electronic and embedded software systems
    - More complex systems:
        - Projects involving more complex components, sensors, actuators and microcontrollers
    - Project complexity:
        - Programme with several subroutines and variables and an extended range of commands
            - typically the system may have to prioritise its response to combinations of multiple sensor outputs
        - e.g. three wind turbine windfarm, monitoring turbine temperature, windspeed and turbine speed and making the appropriate control response.

Be able to design, construct and populate functional PCB circuits

- [L6] Be able to design, construct and populate simple functional PCB circuits
    - Simple PCB circuits:
        - Copper tape or basic CAD software for circuit layout
        - Pen and etch boards
        - Discrete components
        - Soldering up
    - Fault-finding:
        - visual inspection and voltmeter
- [L7] Be able to design, construct and populate functional PCB circuits
    - PCB circuits:
        - Basic CAD software circuit design tool

        - Photo-etch or engraver technique
        - Design with at least one device requiring multiple evenly and closely spaced pads and precise soldering
        - Soldering up
    - Fault-finding:
        - visual inspection and multimeter (voltmeter, continuity, component integrity)
- [L8] Be able to design, construct and populate more complex functional PCB circuits
    - More complex PCB circuits:
        - Fully functional CAD software circuit design tool
        - Board may require advanced design such as clever routing, vias (or hole-through) to allow complex circuitry on a single-sided board
        - Soldering up
    - Fault-finding:
        - visual inspection, multimeter, oscilloscope, signal tracing (where appropriate)

Be able to design and analyse systems to solve problems using electronic and software elements

- [L6] Be able to design and analyse systems to solve simple problems
    - Simple problems-
        - Problems involving basic components, sensors and a microcontroller
    - Analysis:
        - Voltage and current calculations for real applications e.g. simple series and parallel circuits, value of resistor needed with an LED etc
    - Problem complexity:
        - Monitor two independent conditions
        - Adjust one control variable
        - System design through scenario- limited complexity e.g. circuit and programme to control bridge traffic lights.
- [L7] Be able to design and analyse systems to solve problems
    - Problems-
        - Problems involving components, sensors and a microcontroller
    - Analysis:
        - Voltage and current calculations for real applications e.g. Power (IxV) for bulbs/ resistors, resistor values for a potential divider, amplification in a single transistor stage etc.
        - Use of datasheets
        - Interpret component markings and tolerances
    - Problem complexity:
        - Monitor three interdependent conditions
        - Adjust control variables
        - System design through scenario- intermediate complexity e.g. circuit and programme to control simple elevator situation
- [L8] Be able to design and analyse systems to solve more complex problems
    - More complex problems-
        - Problems involving components, sensors, actuators and microcontrollers
    - Analysis:
        - Time constant calculation e.g. for 555
        - Amplification calculation e.g. for opamps

        - Boolean logic (for gates)
    - Problem complexity:
        - Monitor three interdependent conditions remotely
        - Adjust one control variable remotely
        - System design through scenario- increased complexity e.g. circuit and programme to control small windfarm

PROGRAMMING AND COMPUTER SCIENCE

Demonstrate an understanding of concepts across Computer Science and Software Engineering

- [L6] Demonstrate an understanding of the distinguishing concepts of algorithms and programming languages from Computer Science and Software Engineering
    - Understand the concept of an algorithm (vs. a program), and that there are different costs for different algorithms for the same task. {*This could be illustrated with searching (linear and binary) and/or sorting.}*
    - Understand the Programming Language concepts of high level languages, machine languages, interpretation and compilation, and the idea that programming languages are precise.
- [L7] Demonstrate an understanding of fundamental concepts across Computer Science and Software Engineering
    - Appreciate the concepts of complexity, tractability and the notion of computability – the idea that some problems are inherently difficult or impossible to solve on a computer.
    - Understand how coding for compression, error control or encryption enable remarkable technologies e.g.
        - mp3 players,
        - reliable storage and communication,
        - e-commerce
    - Understand that programming languages can be specified using formal grammars or formal diagrams
    - Understand the need for Software Engineering methodologies, and appreciate the steps in the Software Development Life cycle.
- [L8] Demonstrate an appreciation of the field of Computer Science and Software Engineering
    - Investigate defining questions and issues from a number of areas such as Algorithms and Complexity, Architecture, Discrete Structures, Graphics and Visual Computing, HCI, Information management, Intelligent systems, Net-centric Computing, Operating Systems, Programming Languages, Social and Professional Issues, Software Engineering.

Be able to understand, select and design data types, data structures, algorithms, and program structures for a program to meet specified requirements, and evaluate user interfaces.

- [L6] Be able to identify and select data types, and program structures for a program to meet specified requirements, and perform informal evaluation of user interfaces
    - Be aware of primitive data types in the chosen programming language (e.g. integer, real, Boolean, character, string) and be able to select the appropriate one for a task.
    - Understand sequence, selection and iteration.
    - Be able to informally critique user interfaces [Note: informal means based on personal experience rather than using heuristics, but nevertheless making a clear

explanation of the problem; for example, identify a frustrating user interface and explain why it was difficult to use]

- [L7] Be able to understand and select data structures, design program structures for a program to meet specified requirements, and evaluate user interfaces
    - Understand more advanced representations of data (such as arrays, lists or user-defined types), and select the appropriate data type or structure for a task.
    - Understand and design programs with methods (or functions, procedures or subroutines as appropriate to the context)
    - Be able to evaluate a Human-Computer interface in terms of simple usability heuristics [note: for example, Nielsen's usability heuristics would be a suitable framework to use]
- [L8] Be able to understand and select data types, design data structures and program structures, and implement algorithms, for a program to meet specified requirements; and demonstrate an understanding of user interface evaluation.
    - Understand the properties and limitations of data types by understanding binary, decimal and hexadecimal representations, including floating point representations, simple binary arithmetic, and character representation.
    - Design programs to manipulate data stored in arrays or lists.
    - Understand and design programs with methods with parameters and return values (or functions, procedures or subroutines as appropriate to the context).
    - Be able to understand the concept of persistent data (such as files or a database) and program structures for interacting with them.
    - Understand and apply Human-Computer Interaction principles (usability, design methodologies and models of interaction). [note: principles would normally be applied to the evaluation of existing interfaces, although students could design and evaluate their own simple interfaces]

Be able to read, understand, write, and debug software programs using an appropriate programming language, tools, and software development process.

- [L6] Be able to read, understand, write, and debug simple software programs
    - Be able to develop a simple program using variables, expressions, selection, and loops.
    - Be able to develop programs using meaningful variable names, appropriate layout and comments.
- [L7] Be able to read, understand, write, and debug software programs using an appropriate programming language
    - Be able to develop a program using variables, expressions, selection, loops and methods (or functions etc.).
    - Use effective programming style including simple documentation (which may be comments in the program).
    - Be able to test a simple program to identify errors and correct them.
- [L8] Be able to read, understand, write, and debug software programs using a general purpose programming language, tools, and software development process
    - Be able to carry out problem analysis for simple requirements
    - Be able to develop a program using variables, expressions, selection, loops and methods (or functions etc.) to process data in files.
    - Be able to use a software development tool for a general purpose programming language [note: only a simple tool is required e.g. Visual Studio (VB, etc.), BlueJay, Greenfoot, IDLE, simple IDE, etc. but not plain editor and command-line compiler]

- Be able to use a simple software development process, such as a simplified agile programming process with several cycles, test-driven development with separate testers

MATERIAL AND PROCESSING TECHNOLOGIES

BIOLOGICAL AND CHEMICAL-RELATED

Demonstrate understandings of key concepts and processes related to biological and chemical technologies.

- [L6] Demonstrate understandings of fundamental concepts and processes related to aseptic practices, growing organisms, and separating and testing biological and chemical components.
  - Understand the need for hygienic conditions when growing living organisms.
  - Understand the importance of environmental factors for an organism's cultivation and growth
    - e.g., food, temperature, moisture.
  - Understand how the properties of specified biological and chemical components allow for separation using particular techniques.
  - Understand why different techniques are needed to determine whether a biological organism, or a biological or chemical component, has had an effect.
- [L7] Demonstrate understandings of more complex concepts and processes related to aseptic practices, growing organisms, and separating and testing biological and chemical components.
  - Understand how hygienic conditions can be established and maintained when growing living organisms.
  - Understand how different variables affect the growth, reproduction, and/or metabolic activity of an organism.
  - Understand how an organism's growth, reproduction, and/or metabolic activity can be monitored.
  - Understand how separating and testing techniques work and why different techniques are better suited to different tasks.
- [L8] Demonstrate understandings of advanced concepts and processes related to separating and testing biological and chemical components.
  - Understand how biological or chemical components cause particular effect(s).
  - Understand why a range of different techniques can be used to determine the efficacy of a biological or chemical component
  - Understand why particular efficacy-testing techniques would be selected under different conditions/environments.

Demonstrate an ability to safely carry out a range of aseptic, separating, and testing techniques relevant to biological and chemical technologies.

- [L6] Demonstrate an ability to select and carry out simple hygienic, separating, and testing techniques.
  - Be able to select and safely use appropriate equipment to aseptically transfer a bacterial culture, or to prepare scion wood and root stock for grafting.
  - Be able to select and correctly use simple separation techniques. Examples could include chemical separation (e.g., using lemon juice to separate casein protein from

the whey), or solvent extraction (e.g., using ethanol to separate medicinal components from plants3).
    - Be able to select and correctly use an appropriate technique to determine if a chemical or biological component has an effect (positive or negative). Examples could include using a plate metre to determine whether a fertiliser has affected plant growth, or weighing dry matter to determine whether bacteria have produced high energy silage, or measuring pH to determine whether bacteria have produced lactic acid in yoghurt production.
- [L7] Demonstrate an ability to select and carry out more complex aseptic, separating, and testing techniques.
    - Be able to select and safely use appropriate equipment to successfully establish and maintain a viable culture.
        - e.g. by sourcing meristematic tissue and transferring it to an appropriate growth medium or to source a bud, correctly preparing appropriate root stock, and insert the bud into the root stock, or by carrying out streak plating techniques to isolate bacteria, transferring to an appropriate medium, and establishing optimum conditions for growth guarding against contamination .
    - Be able to select and safely and correctly use the appropriate equipment to separate chemical and biological components. Examples could include distillation and fractional distillation to separate essential oils.
    - Be able to measure the efficacy of a chemical or biological component using an accepted laboratory technique. An example could include agar well diffusion to measure the antibacterial properties of a biological or chemical substance.
- [L8] Demonstrate an ability to select and use appropriate laboratory equipment to separate biological and chemical components and test how they achieve a specified effect
    - Be able to select and correctly use laboratory equipment to separate a biological or chemical component of interest. Examples could include the isolation and identification of a yeast culture from a fermented drink, or using column chromatography or gel electrophoresis to isolate a specific protein (or other compound).
    - Be able to select and correctly use one or more techniques to identify the efficacy of a biological or chemical component. An example could include determining whether an antibacterial agent acts by breaking down the cell wall or inhibiting cell reproduction.

Be able to select and apply knowledge and techniques to cultivate a living organism and separate and test components of interest.

- [L6] Be able to grow a specified organism and test the effect of related chemical and/or biological components.
    - Be able to use knowledge of an organism's food and environmental needs to create a suitable growing environment.
    - Be able to establish an organism in the environment
    - Be able to use appropriate separating and testing techniques to determine the effect of related chemical and/or biological components within the environment.

[3] Investigating Maori rongoa needs to take into account appropriate cultural considerations.

        - Examples of contexts could include a terrarium for an insect with potential to be used as a biological control agent, establishing a worm farm, establishing a yoghurt culture.
- [L7] Be able to manage the inputs and outputs of an environment created to support the growth, reproduction, and/or metabolic activity of a specific biological organism.
    - Be able to select and use an appropriate method of monitoring organism growth, reproduction, and/or metabolic activity, for example, in a worm farm, or a yoghurt or cheese or fermented drink.
    - Be able to use knowledge of variables affecting organism growth to manage inputs and outputs in the organism's environment.
- [L8] Be able to optimise the growth, reproduction, and/or metabolic activity of a specific biological organism within an established environment.
    - Be able to identify environmental variables that may affect organism growth, reproduction, and/or metabolic activity and alter these to optimise the environment for a particular outcome
    - Be able to carry out appropriate separation and testing techniques to establish and monitor the efficacy of biological and/or chemical component(s) to inform decisions made to optimise the environment.

FOOD

Demonstrate an understanding of the characteristics, properties and processes of food

- [L6] Demonstrate understanding of the characteristics, properties and processes of everyday food ingredients and products
    - Understanding the function of everyday food ingredients,
    - Understanding food processing operations and their functions
        - e.g. heating, cooling, mixing
    - Understand the methods of home food preservation
        - e.g. bottling, pickling, freezing
    - Understand the concept of consumer sensory evaluation
        - i.e. sample preparation, test design and testing method
    - Understand the concept of physical testing
        - e.g. colour, texture, viscosity, measuring temp
    - Understanding the role of home based food packaging in food containment, preservation and protection from contamination
        - e.g. glass jars, plastic films, home vacuum packing systems, paper bags
- [L7] Demonstrate understanding the characteristics, properties and processes of commercial food ingredients and products
    - Understand the function of commercial food ingredients
    - Understanding how to construct a process flow diagram, process stages, controls and symbols for batch, continuous and multi-unit production
        - e.g. block diagrams, process flow diagram symbols and control points
    - Understand the methods of commercial food preservation
        - e.g. canning, fermentation
    - Understanding of a range of consumer sensory tests
    - e.g. Hedonic, ranking, difference
    - Understand the concept of chemical testing
        - e.g. moisture content, water activity, nutrition content (fat, vitamins, minerals)

    - Understanding the materials their attributes and the role of commonly used industrial food packaging systems
        - e.g. plastic films, multi layer films, foil bags, cans
- [L8] Demonstrate understanding the characteristics, properties and processes of specialist food ingredients and products
    - Understanding the function of specialised food additives
        - e.g. pectins, gums, and starches
    - Understanding the variables of scale up
        - e.g. inputs/outputs, key variables, yields, costing
    - Understand the principles of food preservation in packaged foods
        - e.g. MAP, UHT
    - Understanding complex food packaging systems and their role in preservation of food products
        - e.g. MAP, UHT, retort pouches

Demonstrate an understanding of food safety and food legislation

- [L6] Demonstrate an understanding of the fundamental principles of food safety and food legislation
    - Understand the principles of food safety
        - e.g. good hygiene practices, methods of food preservation
    - Understand the principles of food hygiene legislation
        - i.e. legislation governing preparation of food for sale Food Hygiene Regulations 1974, Food (Safety) Regulations 2002
- [L7] Demonstrate an understanding of the principles of food safety and food legislation in food products
    - Understand the principles of HACCP
        - i.e. the 7 steps to developing a HACCP plan
    - Understand the principles of food packaging / labelling legislation
        - i.e. New Zealand Food Standards Guide to Labelling
- [L8] Demonstrate an understanding of the principles of food safety and food legislation in an industrial setting
    - Understand the principles of HACCP in an industrial setting
        - e.g. develop a HACCP plan for an industrial process
    - Understand ingredient and process legislation
        - e.g. GMP, Weights and Measures 1999, Fair Trading Act 1986, Food Act 1981,

Be able to undertake sensory evaluation testing, construct HACCP plans and use food processes

- [L6] Be able to use simple sensory evaluation tests and construct simple HACCP plans
    - Carry out a preference test using a shelf stable product in a classroom setting
        - e.g. Use an hedonic preference scale to test chocolate chip biscuits
    - Develop a safety plan for a product manufactured in the classroom
        - e.g. hand washing, wearing of hair nets, clothing, testing in-process to ensure correct heating and cooling, correct packaging and storage
    - Carry out a food process using classroom equipment
        - e.g. cutting, mixing, heating, cooling using correct equipment
- [L7] Be able to carry out consumer sensory tests and construct a HACCP plan for a High-Risk Food

- Carry out a consumer sensory test using a product that requires temperature control using respondents outside the classroom
    - e.g. Use ice cream or soup
- Develop a HACCP for a high risk food
    - e.g. meat, fish or diary product
- Construct a process flow diagram for a batch process
    - e.g. Yoghurt making in the classroom

- [L8] Be able to analyse the results of sensory evaluation tests construct a HACCP plan for an industrial process
    - Carry out a statistically significant sensory test using respondents outside the student's school environment
        - e.g. a preference test for children's snack food in a primary school
    - Develop a HACCP plan for an industrial process
    - Construct a process flow diagram for an industrial batch process and conduct a yield analysis and costing
        - e.g. Chocolate making

Be able to select and apply knowledge and techniques to make a specific food product

- [L6] Be able make a food product that requires the application of level 6 knowledge and techniques
    - Use food ingredients provided to safely make a specific everyday food product
        - e.g. Flour, sugar, eggs
    - Select appropriate processes and tests to make a specific everyday food product
        - e.g. whisking vs beating vs folding or dry heat vs wet heat
- [L7] Be able to make a food product that requires the application of level 7 knowledge and techniques
    - Select appropriate food ingredients to safely make a specific consumer food product
        - e.g. milk or egg powder, flour with a specific protein content
    - Select appropriate processes and tests to make a specific consumer food product
- [L8] Be able to enhance a food product that requires the application of level 8 knowledge and techniques
    - Select appropriate food ingredients and additives to safely make a food product that could be made on an industrial scale with an appropriate shelf life
    - Select appropriate processes and in-process tests to make a food product suitable for manufacture on an industrial scale

METAL

Demonstrate understanding about how and why metals are classified and worked.

(Metals include base metals and alloys)

- [L6] Demonstrate understandings of how and why metals are classified, the composition of metal alloys, and how and why these metals can be worked in certain ways.
    - Understand why metals are classified as ferrous and non-ferrous and their suitability for different purposes
    - Explain the composition of commonly used metal alloys and their suitability for different purposes
        - E.g. steel, brass
    - Understand that metals have properties which affects how they can be worked

        - E.g. ductility, malleability, hardness, conductivity, toughness, tensile strength
    - Understand how metals are cut, formed, joined, assembled and finished for specific purposes
        - Cut: E.g. sawn, drilled, milled, ground, sheared, gas/plasma cut, turned, tapped, filed
        - Formed E.g. folded, bent, rolled, forged
        - Joined E.g. welded, brazed, soldered, riveted,
        - Assembled E.g. fastened (i.e. screw, bolt,); clamped; glued, jigged
        - Finished E.g. polished, painted, knurled, anodised, plated
    - Understand the types of commonly used hand and machine tools, how they are categorised, the operations they can perform and how they are used to safely work metals
        - Hand and machine tools E.g. for cutting – understanding the different types of hand and machine tools and how they are categorised e.g. files (i.e. 200mm flat second cut); hammers (i.e. 4oz ball pein) grinders (i.e. bench, disc, cut-off); mill (i.e. vertical, horizontal) lathe (i.e. centre lathe, tool makers lathe)
        - Matching hand and machine tools to the operations required to produce a metal product e.g. lathe for objects requiring rotational symmetry, milling for cuts in x, y and/or z axis; Safe and effective use of tools e.g. guards, stops, correct operating speeds, protective clothing/accessories, jigs, templates, correct cutting speed, feed speed and tool angles for different metals E.g. steel vs aluminium vs brass
- [L7] Demonstrate understandings of how common metals are categorised, ways of improving their working properties, role and importance of tolerances when working with metals, why specific structures are made from different types of metals, and how and why jigs and templates are used when cutting/machining, forming and assembling metal products
    - Understand how and why metals are categorised by size, profile, appearance and composition and how this impacts on their suitability for different purposes
        - Size
        - Profile (tube, box, angle, channel, bar, rod, plate)
        - Appearance e.g. black, bright
        - Composition e.g. chromium %age in stainless steel, carbon content of steel
    - Understand how metals are enhanced to improve their working properties and/or performance (not inc finishes)
        - E.g. varying % of chromium, and other additives (nickel, titanium) enhances properties of stainless steel, annealed, hardened, tempered, electroplated, machining garde materials
    - Understand the role and importance of tolerances when working with metals for specific purposes
        - E.g. Limits and fits, machine tolerances, nominal, safety factors
    - Understand the relationship between metals and their application in specific structures
        - E.g. use of certain metal profiles for a specific functions (i.e. chain used in tension but not in compression, pipe used instead of a solid in applications where torsional forces act,

- Understand how and why jigs and templates are used in cutting/machining metal and when forming and assembling metal products
  - E.g. Maintain tolerances and/or shape
  - E.g. Replication of parts or processes

- [L8] Demonstrate understanding of how shaping, joining and finishing act with the properties of metals to enhance the structural, aesthetic and ergonomic qualities of a product.
  - Understand how heat generated during shaping (cutting, machining and forming), and/or joining can impact on the properties of a metal to enhance or weaken the structural properties of the parent metal/ product and how this impact can be mitigated
    - E.g. shaping by beating hardens metal, heat generated when cutting/machining can harden or anneal specific metals, welding can weaken parent metal
  - Understand how shaping, joining and/or finishing act with the properties of a metal to enhance the aesthetic qualities of a product
    - E.g., safe edge, engineers finish, polished, blued
  - Understand how shaping and/or joining act with the properties of a metal to enhance the ergonomic qualities of a product
    - E.g. chamfers, rounded edges, proportioned to allow comfortable use by end user

Demonstrate an ability to safely and effectively use tools to cut, form, joint, assemble and finish

- [L6] Be able to safely and effectively use hand and machine tools to cut, form, joint, assemble and finish to a high quality
  - Cutting: e.g. using a lathe (facing, parallel turning, taper turning, drilling, knurling); milling (rebate, slot); plasma cutting; chisel; file, drill, shear/snip, tap and die etc
  - Forming: e.g. simple folds, bend, roll, safe-edges, beating, use of formers
  - Jointing: e.g. solder (, soft and hard soldering i.e. braze, silver solder, lead/tin) , mig and/or stick weld, riveting (i.e. solid, pop)
  - Assembly e.g. clamping/holding techniques, select and use a jig
  - Finishing e.g. hand & machine sanding, polishing, painting, knurling, stippling,
- [L7] Be able to safely and effectively setup and use advanced hand and machine tools to cut, form, joint, assemble and finish to a high quality
  - Cutting: e.g. setting up and undertaking gas cutting, plasma cutting, setup a lathe including selection of suitable tools, to turn metal stock to a specified profile;
  - Forming: e.g. complex folds
  - Jointing: e.g. welding, Mig and/or TIG welding of alloys, aluminium,
  - Assembly e.g. construct and use a jig
  - Finishing e.g. selecting and safely applying heat, chemical and machine surface finishes including heat and machine finishes (bluing, buffing, polishing, engineers finish)

Be able to select and apply knowledge and techniques to make a specific metal product

- [L6] Be able make a metal product that requires the application of level 6 knowledge and techniques
  - Use metal provided to make a metal product to established dimensions
  - Select appropriate techniques to cut, form, joint assemble and finish to make a specific metal product

- [L7] Be able to make a metal product that requires the application of level 7 knowledge and techniques
    - Select appropriate metal to make a metal product that is within established tolerances
    - Select appropriate techniques and set up machine tools to cut, form, joint assemble and finish metal when making a specific metal product
- [L8] Be able to enhance a metal product that requires the application of level 8 knowledge
    - Identify and select metals that will provide the structural, aesthetic and/or ergonomic properties specified as required in metal product to be manufactured
    - Select appropriate cutting, machining and joining tools and techniques to achieve the structural, aesthetic and/or ergonomic properties specified as required in a metal product to be manufactured

TEXTILES

Textile refers to any material made of interlacing fibers.
Fabric refers to any material made through weaving, knitting, crocheting, or bonding.
Yarn is produced by spinning raw fibers to produce long strands.

Demonstrate an understanding of physical and sensory properties and behavioural characteristics of textiles and evaluate the impact of properties on performance

- [L6] Demonstrate understandings of how and why fibres are classified, how yarns and fabrics are made, 'making' techniques, how and why textiles can be 'finished' in certain ways
    - Understand how fibres are classified and their suitability for different purposes
        - e.g. structure of wool fibre
    - Understand how yarn is produced and how this affects its working properties
        - e.g. spinning of yarn
    - Understand how common textiles are constructed and their suitability for different purposes
        - e.g. how raw fibres are processed into textiles
    - Understand commonly used 'making' techniques and how they are used to enable textiles to 'behave' or 'look' in certain ways.
        - e.g. knitting -stretch and drape
    - Making techniques include those associated with addition, construction, manipulation, subtraction and finishing
        - addition e.g. attach, fasten, join, laminate, layer, embroider;
        - construction e.g. knit, knot, loop, weave;
        - manipulation e.g. fold, pleat, tuck, gather, smock;
        - subtraction e.g. deconstruct, punch holes, cut;
        - finishing e.g. dyeing, colouration
    - Understand how common finishes affect the working properties of textiles
        - e.g. brushing, dyeing, printing, tentering
- [L7] Demonstrate understandings of properties of textiles and how these affect the way the textile will behave in different situations
    - Understand the physical properties of textiles
        - e.g. resilience/memory, thermal conductivity, absorbency, flammability, stability, elasticity
    - Understand the sensory properties of textiles
        - e.g. touch, sight, smell

- Understand the way in which the physical and sensory properties of textiles can be used to create specific structures and/or create particular behaviours
    - e.g. flexibility
- Understand how textiles can be tested to determine suitability for specific purposes.
    - e.g. testing for fire resistance, durability, water resistance, insulation

- [L8] Demonstrate understanding of how different making techniques act with the properties of textiles to enhance the structural, aesthetic and ergonomic properties of a textile product.
    - Understand how making techniques act with the properties of a textile to enhance structural properties of a product
        - e.g. using a fabric/material that can be heatset into folds/pleats
    - Understand how making techniques act with the properties of a textile to enhance aesthetic properties of a product
        - e.g. use leather and a hole punch
    - Understand how making techniques act with the properties of a textile to enhance aesthetic properties of a product
        - e.g. ergonomic-using a fabric/material thta is supple

Demonstrate an ability to use techniques to work with and/or create textiles and evaluate in terms of properties, performance and potential application

- [L6] Be able to safely and effectively use hand and machine tools to carry out basic techniques of 'making' to create samples and undertake simple testing procedures.
    - addition techniques
        - e.g. attach, fasten, join, laminate, layer, embroider
    - construction techniques
        - e.g. knit, knot, loop, weave
    - manipulation techniques
        - e.g. fold, pleat, tuck, gather, smock
    - subtraction techniques
        - e.g. deconstruct, punch holes, cut
    - finishing techniques
        - e.g. dyeing, colouration
    - property testing
        - e.g. abrasion resistance absorbency, dimensional stability, elastic recovery, colourfast –washing, bleeding, crocking, lightfast, temperature-iron, water, crease resistance, shrinkage, tensile strength
- [L7] Be able to safely and effectively setup and use advanced hand and machine tools to carry out advanced techniques to a high quality and evaluate a textile's potential performance
    - addition techniques
        - e.g. machine embroidery
    - construction techniques
        - e.g.
    - manipulation techniques
        - e.g.
    - subtraction techniques
        - e.g.
    - finishing techniques
        - e.g. printing

- property testing
    - e.g. Undertake a range of property tests on a textile/s and evaluate the inter-relationships for performance for a specific purpose

Be able to select and apply knowledge and techniques to make a specific textile product

(Textile products include garments, personal, furniture or building accessories, soft toys etc. In all cases students may use existing textiles and create their own textiles from raw fibres or yarn.)

- [L6] Be able make a textile product that requires the application of level 6 knowledge and techniques
    - Use knowledge of the textiles provided to select appropriate techniques to make a specific textile product
        - e.g. make a material swatch-B5 / A4 size
- [L7] Be able to make a textile product that requires the application of level 7 knowledge and techniques
    - Select appropriate fibres and/or textiles to make a specific textile product and test their properties to ensure suitability for product.
        - e.g.
    - Select appropriate tools and techniques to prepare and work the selected fibres and/or textiles to make a specific textile product.
        - e.g.
- [L8] Be able to enhance a textile product that requires the application of level 8 knowledge
    - Test an existing textile product for its structural, aesthetic and/or ergonomic properties.
    - Test the properties of fibres and/or textiles to select those most appropriate for use in a textile product which enhances the structural, aesthetic and/or ergonomic properties of the existing textile product.
    - Select and carry out techniques that will act with the properties of the selected fibres and/or textiles to make a textile product with enhanced structural, aesthetic and/or ergonomic properties.

WOOD

Demonstrate understanding about how and why wood and wood composites are classified and worked

- [L6] Demonstrate understandings of how and why woods are classified and initially processed, how wood composites are made, how and why these can be worked in certain ways.
    - Understand why woods are classified as softwood and hardwood and their suitability for different purposes
    - Explain how commonly used composite woods are made and their suitability for different purposes
        - Laminates (e.g. plywood); glued board (MDF, chip board, hardboard)
    - Understand that woods have grain and how it affects its working properties
    - Understand how wood and wood composites are cut, forming, jointed, assembled and finished for specific purposes
        - Marking out/setting out
        - Cutting: E.g. Sawn, chiselled, drilled, routed
        - Forming E.g. steam bending, laminating
        - Jointing E.g. Mortice & tenon, dowelling, dovetail, biscuit, widening

        - Assembling E.g. marking out, fastening (screwing, nailing); clamping; gluing, jigs
        - Finishing E.g. Sanded, painted, oiled, waxed
    - Understand the types of commonly used hand and machine tools and their variations, and how they are used to safely work wood and wood composites
        - Hand and machine tools E.g. for saws – understanding the differences between a tenon saw, hand rip saw, hand cross-cut saw, table saw, compound mitre saw.
        - Matching tool to wood type and/or process undertaken e.g. rip saw used for cutting along the grain
        - Safe use of tools e.g. guards, stops, correct operating speeds, protective clothing/accessories
- [L7] Demonstrate understandings of wood and wood composite grading, tolerances, assembly requirements, ways of improving working properties and how and why specific structures can be made from different types of wood/wood composites.
    - Understand how and why wood and wood composites are graded (size, form, quality) and therefore its suitability for different purposes
        - Rough sawn vs dressed, standard sizing (100 x 50)
        - Profiles (dowel, mouldings)
        - N^{o}1, N^{o}2, & construction grade, moisture content, defects (shakes and knots)
    - Understand how wood and wood composite are enhanced to improve their working properties (not inc finishes)
        - E.g. Kiln drying, tanalising, boric treatment, oil impregnated
    - Understand the role and importance of tolerances when working with wood and wood products for specific purposes
        - E.g. Fitting doors into door jams, loading, dovetail joints, halving joints
    - Understand the relationship between wood and wood composites and their application in specific structures
        - E.g. Wood composites used in bracing,
    - Understand how and why jigs are used to cut and assemble wood and wood composite for specific purposes
        - Maintain tolerances and/or shape
        - Replication of parts or processes
- [L8] Demonstrate understanding of how shaping, joining and finishing act with the properties of wood and wood composites to enhance the structural, aesthetic and ergonomic properties and environmental performance of a product.
    - Understand how shaping (cutting and forming) and/or joining act with the properties of a wood to enhance structural properties of an outcome
        - E.g. Lamination of beams to enhance load bearing abilities, laminating and shaping to allow for strength and flexibility in chair design
    - Understand how shaping, joining and/or finishing act with the properties of a wood to enhance aesthetic properties of an outcome
        - E.g. Bull-nosing, bevelling; grain alignment, inlaying; grain enhancement (oiling)
    - Understand how shaping and/or joining act with the properties of a wood to enhance ergonomic properties of an outcome
        - E.g. laminated chairs (Bent wood chairs)
    - Understand how shaping and/or joining act with the properties of a wood to enhance environmental performance properties of an outcome

- environmental performance are such things as
    - moisture,
    - cold,
    - heat ,
    - light,
    - vibration,
    - impact,
    - friction
- e.g. constructed joints vs surface joints, for shrinkage control, coving for moisture control, drawer runners for friction management

Demonstrate an ability to safely and effectively use tools to cut, form, joint, assemble and finish

- [L6] Be able to safely and effectively use hand and machine tools to cut, form, joint, assemble and finish to a high quality
    - Cutting: e.g. using a lathe (facing, spindle turning, taper turning, drilling); saw (mitre cut); chisel; plane, handheld router (edging mouldings, cutting slots, profiling)
    - Forming: e.g. steam bending and/or laminating to produce simple curves
    - Jointing: e.g. housing, dovetail, halving
    - Assembly e.g. clamping & holding techniques, use of knock-down fittings & fasteners, select and use a jig
    - Finishing e.g. hand & machine sanding, oiling, painting, lacquering, staining,
- [L7] Be able to safely and effectively setup and use advanced hand and machine tools to cut, form, joint, assemble and finish to a high quality
    - Setting out, marking out, interpreting drawings
    - Cutting: e.g. setup a lathe including selection of appropriate tools, use a lathe (cutting to a required profile using templates i.e. matching table legs); mounted/handheld router (plunge cut); saw (compound mitre cut)
    - Forming: e.g. steam bending and/or laminating to produce compound curves
    - Jointing:
    - Assembly e.g. construct and use a jig
    - Finishing e.g. combination finishes to achieve a specific (aging)

Be able to select and apply knowledge and techniques to make a specific wood product

- [L6] Be able make a wood product that requires the application of level 6 knowledge and techniques
    - Use wood and/or wood composite provided to make a wood product to established dimensions
    - Select appropriate techniques to cut, form, joint assemble and finish to make a specific wood product
- [L7] Be able to make a wood product that requires the application of level 7 knowledge and techniques
    - Select appropriate wood and/or wood composite to make a wood product that is within established tolerances
    - Select appropriate techniques and set up hand and machine toolsto cut, form, joint assemble and finish for working selected wood or wood composites to make a specific wood product
- [L8] Be able to enhance a wood product that requires the application of level 8 knowledge

- Identify and select wood and/or wood composite that will provide the structural properties, aesthetic and/or ergonomic qualities specified as required in wood product to be manufactured
- Select appropriate cutting, machining and joining tools and techniques to achieve the structural, aesthetic and/or ergonomic properties specified as required in a wood product to be manufactured