TECHNOLOGICAL PRACTICE: INDICATORS OF PROGRESSION

LEVEL ONE

Teachers should establish if students hold any misconceptions or partial understandings that would inhibit students meeting the level one achievement objectives for the technological practice, and plan learning experiences to challenge and/or progress these as guided by the level one Indicators of Achievement below.

Brief Development

ACHIEVEMENT OBJECTIVE

Students will:

Describe the outcome they are developing and identify the attributes it should have, taking account of the need or opportunity and the resources available.

TEACHER GUIDANCE

To support students to undertake brief development at level one teachers could:

- provide the need or opportunity and develop the conceptual statement in negotiation with the students
- provide a range of attributes for discussion
- guide students to identify the attributes an appropriate outcome should have.

INDICATORS OF ACHIEVEMENT

Students can:

- communicate the outcome to be produced
- identify attributes for an outcome.

Planning for Practice

ACHIEVEMENT OBJECTIVE

Students will:

Outline a general plan to support the development of an outcome, identifying appropriate steps and resources.

TEACHER GUIDANCE

To support students to undertake planning for practice at level one teachers could:

- ensure that there is a brief against which planning to develop an outcome can occur
- provide students with a detailed plan of what they will be doing during their technological practice. This could be presented and explained as a design process the teacher has developed, with key stages that need to happen clearly identified within it
- provide a range of appropriate resources for students to select from.

INDICATORS OF ACHIEVEMENT

Students can:

- describe what they have done already
- identify what they will do next
- identify the resources they might use.

Outcome Development & Evaluation

ACHIEVEMENT OBJECTIVE

Students will:

Investigate a context to communicate potential outcomes. Evaluate these against attributes; select and develop an outcome in keeping with the identified attributes.

TEACHER GUIDANCE

To support students to undertake outcome development and evaluation at level one teachers could:

- ensure that there is a brief with attributes against which a developed outcome can be evaluated
- establish an environment that encourages and supports student innovation when generating design ideas
- provide opportunities to develop drawing and modelling skills to communicate and explore design ideas. Emphasis should be on progressing 2D and 3D drawing skills and using manipulative media such as plasticine, wire, card etc
- provide opportunities to develop skills required to produce their outcome.

INDICATORS OF ACHIEVEMENT

Students can:

- describe potential outcomes, through drawing, models and/or verbally.
- identify potential outcomes that are in keeping with the attributes, and selects one to produce
- produce an outcome in keeping with identified attributes.

LEVEL TWO

Teachers should establish if students have developed robust level one competencies and are ready to begin working towards level two achievement objectives for the technological practice components, and plan learning experiences to progress these as guided by the level two Indicators of Achievement below.

Brief Development

ACHIEVEMENT OBJECTIVE

Students will:

Explain the outcome they are developing and describe the attributes it should have, taking account of the need or opportunity and the resources available.

TEACHER GUIDANCE

To support students to undertake brief development at level two teachers could:

- provide the need or opportunity and develop the conceptual statement in negotiation with the students
- guide students to discuss the implications of the need or opportunity and the conceptual statements and support them to establish a list of attributes an appropriate outcome could have
- provide students with an overview of the resources available and guide them to take this into account when identifying the attributes for the outcome

INDICATORS OF ACHIEVEMENT

Students can:

- explain the outcome to be produced
- describe the attributes for an outcome that take account of the need or opportunity being addressed and the resources available.

Planning for Practice

ACHIEVEMENT OBJECTIVE

Students will:

Develop a plan that identifies the key stages and the resources available.

TEACHER GUIDANCE

To support students to undertake planning for practice at level two teachers could:

- ensure that there is a brief against which planning to develop an outcome can occur
- provide students with an overview of the stages they will be working through during their technological practice. This could be presented and explained as a design process the teacher has developed, and it could be used to support students to identify what the key stages are
- provide a range of appropriate resources and guide students to decide which of these they wish to use in their outcome.

INDICATORS OF ACHIEVEMENT

Students can:

- identify and record the key stages and resources required to produce their outcome
- describe what they have done already and what resources have been used
- explain what they are going to do next.

Outcome Development & Evaluation

ACHIEVEMENT OBJECTIVE

Students will:

Investigate a context to develop potential outcomes. Evaluate these against identified attributes; select and develop an outcome. Evaluate the outcome in terms of the need/ opportunity.

TEACHER GUIDANCE

To support students to undertake outcome development and evaluation at level two teachers could:

- ensure that there is a brief with attributes against which a developed outcome can be evaluated
- establish an environment that encourages and supports student innovation when generating design ideas
- provide opportunities to develop drawing and modelling skills to communicate and explore design ideas. Emphasis should be on progressing 2D and 3D drawing skills and using manipulative media such as plasticine, wire, card etc
- provide opportunities to develop skills required to produce their outcome
- guide students to evaluate their outcome against the brief.

INDICATORS OF ACHIEVEMENT

Students can:

- describe potential outcomes, through drawing, models and/or verbally
- evaluate potential outcomes in terms of identified attributes to select the outcome to produce
- produce an outcome in keeping with the brief
- evaluate the final outcome in terms of how successfully it addresses the brief.

LEVEL THREE

Teachers should establish if students have developed robust level two competencies and are ready to begin working towards level three achievement objectives for the technological practice components, and plan learning experiences to progress these as guided by the level three Indicators of Achievement below.

Brief Development

ACHIEVEMENT OBJECTIVE

Students will:

Describe the nature of an intended outcome, explaining how it addresses the need or opportunity. Describe the key attributes that enable development and evaluation of an outcome.

TEACHER GUIDANCE

To support students to undertake brief development at level three teachers could:

- provide the need or opportunity and develop the conceptual statement in negotiation with the students
- guide students to describe the physical and functional nature of an outcome (eg, what it looks like and what it can do) taking into account the need or opportunity, conceptual statements and resources available
- guide students to identify the key attributes an appropriate outcome should have. Key attributes reflect those that are deemed essential for the successful function of the outcome.

INDICATORS OF ACHIEVEMENT

Students can:

- describe the physical and functional nature of the outcome they are going to produce and explain how the outcome will have the ability to address the need or opportunity
- describe attributes for the outcome and identify those which are key for the development and evaluation of an outcome.

Planning for Practice

ACHIEVEMENT OBJECTIVE

Students will:

Undertake planning to identify the key stages and resources required to develop an outcome. Revisit planning to include reviews of progress and identify implications for subsequent decision making.

TEACHER GUIDANCE

To support students to undertake planning for practice at level three teachers could:

- ensure that there is a brief against which planning to develop an outcome can occur
- provide students with an overview of what they will need to do during their technological practice and guide students to develop their own design process
- provide a range of resources for students to select from and guide students to select those that will be appropriate for their outcome
- guide students to review their plans at key points and reflect on progress to make informed decisions regarding earlier plans and resources

INDICATORS OF ACHIEVEMENT

Students can:

- develop a plan that identifies key stages, and resources required to produce their outcome
- review progress through the keys stages and resources used to date and use this to inform future planning decisions.

Outcome Development & Evaluation

ACHIEVEMENT OBJECTIVE

Students will:

Investigate a context to develop ideas for potential outcomes. Trial and evaluate these against key attributes to select and develop an outcome to address the need or opportunity. Evaluate this outcome against the key attributes and how it addresses the need or opportunity.

TEACHER GUIDANCE

To support students to undertake outcome development and evaluation at level three teachers could:

- ensure that there is a brief with attributes against which a developed outcome can be evaluated
- establish an environment that encourages and supports student innovation when generating design ideas
- provide opportunities to develop drawing and modelling skills to communicate and explore design ideas. Emphasis should be on progressing 2D and 3D drawing skills and using manipulative media such as plasticine, wire, card etc
- provide opportunity to develop knowledge and skills related to the materials/components they will use
- support students to evaluate their outcome against the brief.

INDICATORS OF ACHIEVEMENT

Students can:

- describe design ideas (either through drawing, models and/or verbally) for potential outcomes
- evaluate design ideas in terms of key attributes to develop a conceptual design for the outcome
- evaluate suitability of materials/components, based on their performance properties, to select those appropriate for use in the production of the outcome
- produce an outcome that addresses the brief
- evaluate the final outcome against the key attributes to determine how well it met the need or opportunity.

TECHNOLOGICAL PRACTICE: INDICATORS OF PROGRESSION

LEVEL FOUR

Teachers should establish if students have developed robust level three competencies and are ready to begin working towards level four achievement objectives for the technological practice components, and plan learning experiences to progress these as guided by the level four Indicators of Achievement below.

Brief Development

ACHIEVEMENT OBJECTIVE

Students will:

Justify the nature of an intended outcome in relation to the need or opportunity. Describe the key attributes identified in stakeholder feedback, which will inform the development of an outcome and its evaluation.

TEACHER GUIDANCE

To support students to undertake brief development at level four teachers could:

- provide an appropriate context and issue that allows students to access resources (including key stakeholders)
- guide students to identify a need or opportunity and develop a conceptual statement
- guide students to understand the physical and functional nature required of an outcome, and how the key attributes relate to this
- guide students to consider the key stakeholders and the environment where the outcome will be located.

INDICATORS OF ACHIEVEMENT

Students can:

- identify a need or opportunity from the given context and issue
- establish a conceptual statement that communicates the nature of the outcome and why such an outcome should be developed
- establish the key attributes for an outcome informed by stakeholder considerations
- communicate key attributes that allow an outcome to be evaluated as fit for purpose.

Planning for Practice

ACHIEVEMENT OBJECTIVE

Students will:

Undertake planning that includes reviewing the effectiveness of past actions and resourcing, exploring implications for future actions and accessing of resources, and consideration of stakeholder feedback, to enable the development of an outcome.

TEACHER GUIDANCE

To support students to undertake planning for practice at level four teachers could:

- ensure that there is a brief against which planning to develop an outcome can occur
- provide planning tools and support students to record key stages and resources needed, including when they will need to access stakeholder feedback. (Please note; records only need to capture what students plan to do and what they need to do it to guide their practice and allow them to review this periodically)
- support students to review their plans at key points and reflect on progress to make informed decisions regarding earlier plans and resources
- support students in organising their resources (including time, money, materials, equipment and access to stakeholders etc).

INDICATORS OF ACHIEVEMENT

Students can:

- establish a plan to manage resources and stakeholder interactions, setting out key stages, actions to be undertaken and progress review points
- review progress according to the current plan, and revise planning as appropriate to ensure completion of outcome.

Outcome Development & Evaluation

ACHIEVEMENT OBJECTIVE

Students will:

Investigate a context to develop ideas for feasible outcomes. Undertake functional modelling that takes account of stakeholder feedback, in order to select and develop the outcome that best addresses the key attributes. Incorporating stakeholder feedback, evaluate the outcome's fitness for purpose in terms of how well it addresses the need or opportunity.

TEACHER GUIDANCE

To support students to undertake outcome development and evaluation at level four teachers could:

- ensure that there is a brief with attributes against which a developed outcome can be evaluated
- establish an environment that encourages and supports student innovation when generating design ideas
- provide opportunities to develop drawing and modelling skills to communicate and explore design ideas. Emphasis should be on progressing 2D and 3D drawing skills and increasing the range and complexity of functional modelling
- provide a range of materials/components and the opportunity to develop the necessary knowledge and skills to test and use them
- guide students to evaluate outcomes in situ against key attributes.

INDICATORS OF ACHIEVEMENT

Students can:

- describes design ideas (either through drawing, models and/or verbally) or potential outcomes
- undertake functional modelling to develop design ideas into a conceptual design that addresses the key attributes
- evaluate suitability of materials/components, based on their performance properties, to select those appropriate for use in the production of a feasible outcome
- produce and trial a prototype of the outcome
- evaluate the fitness for purpose of the final outcome against the key attributes.

LEVEL FIVE

Teachers should establish if students have developed robust level four competencies and are ready to begin working towards level five achievement objectives for the technological practice components, and plan learning experiences to these as guided by the level five Indicators of Achievement below.

Brief Development

ACHIEVEMENT OBJECTIVE

Students will:

Justify the nature of an intended outcome in relation to the need or opportunity. Describe specifications that reflect key stakeholder feedback and that will inform the development of an outcome and its evaluation.

TEACHER GUIDANCE

To support students to undertake brief development at level five teachers could:

- provide an appropriate context and issue that allows students to access resources (including key stakeholders)
- support students to identify a need or opportunity and develop a conceptual statement
- support students understand the physical and functional nature required of an outcome
- guide students to develop key attributes into specifications.

INDICATORS OF ACHIEVEMENT

Students can:

- identify a need or opportunity from the given context and issue
- establish a conceptual statement that justifies the nature of the outcome and why such an outcome should be developed
- establish the specifications for an outcome based on the nature of the outcome required to address the need or opportunity, and informed by key stakeholder considerations
- communicate specifications that allow an outcome to be evaluated as fit for purpose.

Planning for Practice

ACHIEVEMENT OBJECTIVE

Students will:

Analyse their own and others' planning practices to inform the selection and use of planning tools. Use these to support and justify planning decisions (including those relating to the management of resources) that will see the development of an outcome through to completion.

TEACHER GUIDANCE

To support students to undertake planning for practice at level five teachers could:

- ensure that there is a brief against which planning to develop an outcome can occur
- provide a range of planning tools and support students to analyse these to inform selection of the tools they will use to record[1] their planning (Please note; records only need to capture what students plan to do and what they need to do it to guide their practice and allow them to review this periodically)
- support students to review past planning decisions in an ongoing manner and evaluate progress to inform their ongoing planning
- support students to manage their resources (including time, materials, money, equipment and access to stakeholders etc).

INDICATORS OF ACHIEVEMENT

Students can:

- select and use planning tools to identify and record key stages, actions to be undertaken, determine progress review points, and manage resources
- use planning tools to record initial plans and ongoing revisions in ways which provide justification for planning decisions made.

Outcome Development & Evaluation

ACHIEVEMENT OBJECTIVE

Students will:

Analyse their own and others' outcomes to inform the development of ideas for feasible outcomes. Undertake ongoing functional modelling and evaluation that takes account of key stakeholder feedback and trialling in the physical and social environments. Use the information gained to select and develop the outcome that best addresses the specifications. Evaluate the final outcome's fitness for purpose against the brief.

TEACHER GUIDANCE

To support students to undertake outcome development and evaluation at level five teachers could:

- ensure that there is a brief with clear specifications against which a developed outcome can be evaluated
- establish an environment that supports student innovation and encourages analysis of existing outcomes
- provide opportunities to develop drawing and modelling skills to communicate and explore design ideas. Emphasis should be on progressing 2D and 3D drawing skills and increasing the range and complexity of functional modelling
- provide a range of materials/components and the opportunity to develop the necessary knowledge and skills to test and use them
- guide students to evaluate outcomes in situ against brief specifications.

INDICATORS OF ACHIEVEMENT

Students can:

- generate design ideas that are informed by research and analysis of existing outcomes
- undertake functional modelling to develop design ideas into a conceptual design that addresses the specifications
- evaluate suitability of materials/components, based on their performance properties, to select those appropriate for use in the production of a feasible outcome
- produce and trial a prototype of the outcome
- evaluate the fitness for purpose of the final outcome against the specifications.

LEVEL SIX

Teachers should establish if students have developed robust level five competencies and are ready to begin working towards level six achievement objectives for the technological practice components, and plan learning experiences to progress these as guided by the level six Indicators of Achievement below.

Brief Development

ACHIEVEMENT OBJECTIVE

Students will:

Justify the nature of an intended outcome in relation to the need or opportunity and justify specifications in terms of key stakeholder feedback and wider community considerations.

TEACHER GUIDANCE

To support students to undertake brief development at level six teachers could:

- provide an appropriate context and issue that allows students to access resources (including key stakeholders) and guide them to take into account wider community considerations
- ensure students identify a need or opportunity relevant to the given issue and context
- ensure students understand the physical and functional nature required of an outcome
- support students to develop specifications and justify them based on key and wider community stakeholder considerations.

INDICATORS OF ACHIEVEMENT

Students can:

- identify a need or opportunity from the given context and issue
- establish a conceptual statement that justifies the nature of the outcome and why such an outcome should be developed
- establish the specifications for an outcome as based on the nature of the outcome required to address the need or opportunity, consideration of the environment in which the outcome will be situated and resources available
- communicate specifications that allow an outcome to be evaluated as fit for purpose.
- justify the specifications in terms of key and wider community stakeholder considerations.

Planning for Practice

ACHIEVEMENT OBJECTIVE

Students will:

Critically analyse their own and others' past and current planning practices in order to make informed selection and effective use of planning tools. Use these to support and justify ongoing planning that will see the development of an outcome through to completion.

TEACHER GUIDANCE

To support students to undertake planning for practice at level six teachers could:

- ensure that there is a brief against which planning to develop an outcome can occur
- support students to critically analyse a range of planning tools that have been used in past practice
- ensure tools selected by students will provide appropriate support for their practice
- support students to use selected tools to effectively manage resources (including time, materials, money, equipment and access to stakeholders etc) to enable the outcome produced to successfully meet the brief.

INDICATORS OF ACHIEVEMENT

Students can:

- select appropriate planning tools informed by the critical analysis of own and others' planning practices
- use planning tools to plan for the effective management of resources to ensure completion of an outcome
- use planning tools to record initial plans and ongoing revisions in ways which provide justification for planning decisions made.

Outcome Development & Evaluation

ACHIEVEMENT OBJECTIVE

Students will:

Critically analyse their own and others' outcomes to inform the development of ideas for feasible outcomes. Undertake ongoing experimentation and functional modelling, taking account of stakeholder feedback and trialling in the physical and social environments. Use the information gained to select, justify, and develop a final outcome. Evaluate this outcome's fitness for purpose against the brief and justify the evaluation using feedback from stakeholders.

TEACHER GUIDANCE

To support students to undertake outcome development and evaluation at level six teachers could:

- ensure that there is a brief with clear specifications against which a developed outcome can be evaluated
- establish an environment that supports student innovation and encourages critical analysis of existing outcomes
- provide opportunities to develop drawing and modelling skills to communicate and explore design ideas. Emphasis should be on progressing 2D and 3D drawing skills and increasing the range and complexity of functional modelling
- provide a range of materials/components and the opportunity to develop the necessary knowledge and skills to test and use them
- support students to undertake prototyping to evaluate the outcome's fitness for purpose and identify any further development requirements
- ensure students gain targeted stakeholder feedback.

INDICATORS OF ACHIEVEMENT

Students can:

- generate design ideas that are informed by research and the critical analysis of existing outcomes
- undertake functional modelling to refine design ideas and enhance their ability to address the specifications
- evaluate design ideas in terms of their ability to support the development of a conceptual design for a feasible outcome
- evaluate the conceptual design against the specifications to determine the proposed outcomes potential fitness for purpose
- evaluate suitability of materials/components, based on their performance properties, to select those appropriate for use in the production of a feasible outcome
- produce and trial a prototype of the outcome to evaluate its fitness for purpose and identify any changes that would enhance the outcome
- use stakeholder feedback to support and justify key design decisions and evaluations of fitness for purpose.

TECHNOLOGICAL PRACTICE: INDICATORS OF PROGRESSION

LEVEL SEVEN

Teachers should establish if students have developed robust level six competencies and are ready to begin working towards level seven achievement objectives for the technological practice components, and plan learning experiences to progress these as guided by the level seven Indicators of Achievement below.

Brief Development

ACHIEVEMENT OBJECTIVE

Students will:

Justify the nature of an intended outcome in relation to the issue to be resolved and justify specifications in terms of key stakeholder feedback and wider community considerations.

TEACHER GUIDANCE

To support students to undertake brief development at level seven teachers could:

- provide a context that offers a range of issues for students to explore
- support students to select an authentic issue within the context. An authentic issue is one which is connected to the context, and allows students to develop a brief for a need or opportunity that can be managed within the boundaries of their available resources.
- ensure students identify a need or opportunity relevant to the issue
- ensure students understand the physical and functional nature required of an outcome
- support students to justify the nature of their outcome in terms of the issue it is addressing
- support students to develop specifications and provide justifications for them drawing from stakeholder feedback, and wider community considerations such as the resources available to develop the outcome, ongoing maintenance of the outcome once implemented, sustainability of resources used to develop the outcome and the outcome itself, disposal of the developed outcome when past its use by date.

INDICATORS OF ACHIEVEMENT

Students can:

- explore the context to select an issue
- identify a need or opportunity relevant to their selected issue
- establish a conceptual statement that justifies the nature of the outcome and why such an outcome should be developed with reference to the issue it is addressing
- establish the specifications for an outcome using stakeholder feedback, and based on the nature of the outcome required to address the need or opportunity, consideration of the environment in which the outcome will be situated, and resources available
- communicate specifications that allow an outcome to be evaluated as fit for purpose
- justify the specifications in terms of stakeholder feedback, and the nature of the outcome required to address the need or opportunity, consideration of the environment in which the outcome will be situated, and resources available.

Planning for Practice

ACHIEVEMENT OBJECTIVE

Students will:

Critically analyse their own and others' past and current planning and management practices in order to develop and employ project management practices that will ensure the effective development of an outcome to completion.

TEACHER GUIDANCE

To support students to undertake planning for practice at level seven teachers could:

- ensure that there is a brief against which planning to develop an outcome can occur
- support students to critically analyse a range of planning tools and project management practices that have been used in past technological practice
- support students to use selected tools to effectively manage resources (including time, materials, money, equipment and access to stakeholders etc) to enable the outcome produced to successfully meet the brief.

INDICATORS OF ACHIEVEMENT

Students can:

- select appropriate planning tools and develops project management practices informed by the critical analysis of own and others' planning practices
- use planning tools and project management practices to plan for the effective management of resources to ensure completion of an outcome
- use planning tools to record initial plans and ongoing revisions in ways which provide justification for project management practices employed.

Outcome Development & Evaluation

ACHIEVEMENT OBJECTIVE

Students will:

Critically analyse their own and others' outcomes and evaluative practices to inform the development of ideas for feasible outcomes. Undertake a critical evaluation that is informed by ongoing experimentation and functional modelling, stakeholder feedback, and trialling in the physical and social environments. Use the information gained to select, justify, and develop an outcome. Evaluate this outcome's fitness for purpose against the brief. Justify the evaluation using feedback from stakeholders and demonstrating a critical understanding of the issue.

TEACHER GUIDANCE

To support students to undertake outcome development and evaluation at level seven teachers could:

- ensure that there is a brief with clear specifications against which a developed outcome can be evaluated
- establish an environment that supports student innovation and encourages critical analysis of existing outcomes
- support students to critically analyse evaluative practices used within functional modelling
- provide opportunities to develop drawing and modelling skills to communicate and explore design ideas. Emphasis should be on progressing 2D and 3D drawing skills and increasing the range and complexity of functional modelling
- provide a range of materials/components and the opportunity to develop the necessary knowledge and skills to test and use them
- support students to undertake prototyping to gain evidence that enables clear judgments regarding the outcome's fitness for purpose and determine the need for any changes to enhance the outcome
- support students to gain targeted stakeholder feedback and understand the implications of the physical and social environment in which the outcome is to be located.

INDICATORS OF ACHIEVEMENT

Students can:

- generate design ideas that are informed by research and critical analysis of existing outcomes
- develop design ideas for outcomes that are justified as feasible with evidence gained through functional modelling
- critically analyse evaluative practices used when functional modelling to inform own functional modelling
- undertake functional modelling to evaluate design ideas and develop and test a conceptual design to provide evidence of the proposed outcome's ability to be fit for purpose
- evaluate suitability of materials/components, based on their performance properties, to select those appropriate for use in the production of a feasible outcome
- undertake prototyping to gain specific evidence of an outcomes fitness for purpose and use this to justify any decisions to refine, modify and/or accept the outcome as final
- use stakeholder feedback and an understanding of the physical and social requirements of where the outcome will be situated to support and justify key design decisions and evaluations of fitness for purpose.

LEVEL EIGHT

Teachers should establish if students have developed robust level seven competencies and are ready to begin working towards level eight achievement objectives for the technological practice components, and plan learning experiences to progress these as guided by the level eight Indicators of Achievement below.

Brief Development

ACHIEVEMENT OBJECTIVE

Students will:

Justify the nature of an intended outcome in relation to the context and the issue to be resolved. Justify specifications in terms of key stakeholder feedback and wider community considerations.

TEACHER GUIDANCE

To support students to undertake brief development at level eight teachers could:

- support students to identify a context that offers a range of issues for them to explore
- ensure students select an authentic issue within their selected context
- ensure students identify a need or opportunity relevant to the issue and context
- ensure students understand the physical and functional nature required of an outcome
- support students to justify the nature of their outcome in terms of the issue and context
- support students to develop and justify specifications that will allow the evaluation of the outcome and its development to be judged as fit for purpose in the broadest sense. Fitness for purpose in its broadest sense refers to the 'fitness' of the outcome itself as well as the practices used to develop the outcome (eg, such things as the sustainability of resources used, ethical nature of testing practices, cultural appropriateness of trialing procedures, determination of lifecycle and ultimate disposal).

INDICATORS OF ACHIEVEMENT

Students can:

- identify and evaluate a range of contexts to select an authentic issue
- identify a need or opportunity relevant to their selected issue
- establish a conceptual statement that justifies the nature of the outcome and why such an outcome should be developed with reference to the issue being addressed and the wider context
- establish the specifications for an outcome and its development using stakeholder feedback and based on the nature of the outcome required to address the need or opportunity, consideration of the environment in which the outcome will be situated, and resources available
- communicate specifications that allow an outcome to be evaluated as fit for purpose in the broadest sense.
- justify the specifications as based on stakeholder feedback and the nature of the outcome required to address the need or opportunity, consideration of the environment in which the outcome will be situated, and resources available.

Planning for Practice

ACHIEVEMENT OBJECTIVE

Students will:

Critically analyse their own and others' past and current planning and management practices in order to develop and employ project management practices that will ensure the efficient development of an outcome to completion.

TEACHER GUIDANCE

To support students to undertake planning for practice at level eight teachers could:

- ensure that there is a brief against which planning to develop an outcome can occur
- ensure students critically analyse a range of planning tools and project management practices that have been used in past technological practice
- support students to select planning tools and project management practices that will ensure the efficient development of an outcome to completion. Efficient management of resources ensures that the use of time, material and people is optimised during the development and production of an outcome that successfully meets the brief.

INDICATORS OF ACHIEVEMENT

Students can:

- select appropriate planning tools and develops project management practices informed by the critical analysis of own and others' planning practices
- use planning tools and project management practices to plan for the efficient management of resources to ensure completion of an outcome
- use planning tools to record initial plans and ongoing revisions in ways which provide justification for project management practices employed.

Outcome Development & Evaluation

ACHIEVEMENT OBJECTIVE

Students will:

Critically analyse their own and others' outcomes and their determination of fitness for purpose in order to inform the development of ideas for feasible outcomes. Undertake a critical evaluation that is informed by ongoing experimentation and functional modelling, stakeholder feedback, trialling in the physical and social environments, and an understanding of the issue as it relates to the wider context. Use the information gained to select, justify, and develop an outcome. Evaluate this outcome's fitness for purpose against the brief. Justify the evaluation using feedback from stakeholders and demonstrating a critical understanding of the issue that takes account of all contextual dimensions.

TEACHER GUIDANCE

To support students to undertake outcome development and evaluation at level eight teachers could:

- ensure that there is a brief with clear specifications against which a developed outcome can be evaluated
- establish an environment that supports student innovation and encourages critical analysis of existing outcomes and knowledge of material innovations
- support students to critically analyse the ways in which the fitness for purpose of existing outcomes have been determined, and how appropriate development practices were established
- provide opportunities to develop drawing and modelling skills to communicate and explore design ideas. Emphasis should be on progressing 2D and 3D drawing skills and increasing the range and complexity of functional modelling
- provide a range of materials/components and the opportunity to develop the necessary knowledge and skills to test and use them, and support students to establish which would be optimal for use when taking into account all contextual dimensions
- support students to undertake prototyping to gain evidence that enables clear judgments regarding the outcome's fitness for purpose and determine the need for any changes to enhance the outcome
- ensure students gain targeted stakeholder feedback and understand the implications of the physical and social environment in which the outcome is to be located.

INDICATORS OF ACHIEVEMENT

Students can:

- generate design ideas that are informed by research and critical analysis of existing outcomes and knowledge of material innovations
- develop design ideas for feasible outcomes that are justified with evidence gained through functional modelling that serves to gather evidence from multiple stakeholders and test designs ideas from a range of perspectives
- undertake evaluation of design ideas informed by critical analysis of evaluative practices to support the development of a conceptual design for an outcome that optimises resources and takes into account maintenance and disposal implications
- undertake functional modelling of the conceptual design to provide evidence that the proposed outcome has the potential to be fit for purpose
- evaluate suitability of materials/components, based on their performance properties, to select those appropriate for use in the production of a feasible outcome that optimises resources and takes into account maintenance and disposal implications
- undertake prototyping to gain specific evidence of an outcomes fitness for purpose and use this to justify any decisions to refine, modify and/ or accept the outcome as final
- use stakeholder feedback and an understanding of the physical and social requirements of where the outcome will be situated to support and justify an evaluation of the outcome and development practices as fit for purpose.

NATURE OF TECHNOLOGY: INDICATORS OF PROGRESSION

LEVEL ONE

Teachers should establish if students hold any misconceptions or partial understandings that would inhibit students meeting the level one achievement objectives for the nature of technology and plan learning experiences to challenge and/or progress these as guided by the level one Indicators of Achievement below.

Characteristics of Technology

ACHIEVEMENT OBJECTIVE

Students will:

Understand that technology is purposeful intervention through design

TEACHER GUIDANCE

To support students to develop understanding of characteristics of technology at level 1, teachers could:

- provide opportunities for students to discuss what is meant by the made world and the natural world
- provide students with examples of technologists and guide them to identify the sort of things they do as part of their technological practice. Technological practice involves the defining practices underpinning the development of a brief, the organizing practices underpinning planning, and the production and evaluation practices involved in the development of an outcome that is fit for purpose as defined by the brief.
- guide students to identify that the purpose of technology is to design and create outcomes to carry out specific functions

INDICATORS OF ACHIEVEMENT

Students can:

- identify that technology involves people designing and creating technological outcomes for an identified purpose
- identify that technological practice involves knowing what you are making and why, planning what to do and what resources are needed, and making and evaluating an outcome

Characteristics of Technological Outcomes

ACHIEVEMENT OBJECTIVE

Students will:

Understand that technological outcomes are products or systems developed by people and have a physical nature and a functional nature.

TEACHER GUIDANCE

To support students to develop understanding of characteristics of technological outcomes at level 1, teachers could:

- provide students with a range of contemporary and historical technological products and systems and guide them to recognise these as examples of technological outcomes developed by people to be a part of the made world.
- guide students to describe the physical nature of technological outcomes. The physical nature of technological outcomes refers to such things as size, shape, colour, smell, texture, components etc.
- guide students to describe the functional nature of technological outcomes. The functional nature of technological outcomes refers to what the outcome does.

INDICATORS OF ACHIEVEMENT

Students can:

- explain that technological outcomes are made by people
- describe selected technological outcomes in terms of their physical nature
- describe selected technological outcomes in terms of their functional nature.

LEVEL TWO

Teachers should establish if students have developed robust level one understandings and are ready to begin working towards level two achievement objectives for the nature of technology and plan learning experiences to progress these as guided by the level two Indicators of Achievement below.

Characteristics of Technology

ACHIEVEMENT OBJECTIVE

Students will:

Understand that technology both reflects and changes society and the environment and increases people's capability.

TEACHER GUIDANCE

To support students to develop understanding of characteristics of technology at level 2, teachers could:

- provide opportunities for students to discuss the made world, the natural world and the social world and relationships between them
- provide students with examples of technological outcomes and guide them to understand how they can increase people's capability to do things. Examples should allow students to recognize that increasing capability may result in both positive and negative impacts on society and/or the environment
- provide students with examples of technological developments and guide them to identify how society and the environment influenced the decisions made
- provide students with the opportunity to explore a range of technological developments and guide them to identify examples of positive and negative impacts on people and/or the environment

INDICATORS OF ACHIEVEMENT

Students can:

- identify influences on particular technological developments
- identify how particular technological outcomes have changed how people do things
- describe examples to illustrate how a technological development has had a positive impact on society and/or the environment
- describe examples to illustrate how a technological development has had a negative impact on society and/or the environment

Characteristics of Technological Outcomes

ACHIEVEMENT OBJECTIVE

Students will:

Understand that technological outcomes are developed through technological practice and have related physical and functional natures.

TEACHER GUIDANCE

To support students to develop understanding of characteristics of technological outcomes at level 2, teachers could:

- provide students with a range of technological outcomes and other objects and guide them to identify which of these could be described as technological outcomes and why. Technological outcomes are defined as fully realised products and systems, created by people for an identified purpose through technological practice. Once the technological outcome is placed in situ, no further design input is required for the outcome to function. Taking this definition into account, technological outcomes can be distinguished from natural objects (such as trees and rocks etc), and works of art, and other outcomes of human activity (such as language, knowledge, social structures, organisational systems etc).
- provide students with a range of technological outcomes and guide them to identify them as technological products or systems. Identifying an outcome as a product or system will determine the description of its physical nature. For example, if a technological outcome is identified as a product, the focus for describing its physical nature will be on the materials it is made from. If a technological outcome is identified as a system, the focus for describing its physical nature will be on the components within it and how they are connected.
- guide students to identify that link between physical and functional attributes in technological outcomes. For example the flat bottom of a cup (physical attribute) allows it to be stable on a flat surface (functional attribute).

INDICATORS OF ACHIEVEMENT

Students can:

- explain how a technological outcome can be distinguished from other things created by people
- identify a technological outcome as a product and describe its physical nature in terms of the materials it is made from
- identify a technological outcome as a system and describe its physical nature in terms of the components within it and how they are connected
- identify links between the physical and functional attributes of particular technological outcomes

LEVEL THREE

Teachers should establish if students have developed robust level two understandings and are ready to begin working towards level three achievement objectives for the nature of technology and plan learning experiences to progress these as guided by the level three Indicators of Achievement below.

Characteristics of Technology

ACHIEVEMENT OBJECTIVE

Students will:

Understand how society and environments impact on and are influenced by technology in historical and contemporary contexts and that technological knowledge is validated by successful function.

TEACHER GUIDANCE

To support students to develop understanding of characteristics of technology at level 3, teachers could:

- provide students with examples of technological practice and guide them to understand how social and/or environmental issues have influenced the development of the brief, planning decisions, and the development and evaluation of outcomes
- provide students with the opportunity to explore a range of technological developments and support them to determine why changes in technological outcomes have occurred over time. Reasons for changes refer to such things as changing needs, fashions, attitudes and the development of new materials, skills and knowledge
- support students to determine the impacts different technological developments have had on society and/or the environment over time
- provide students opportunity to identify that knowledge is valued for what it can do and support students to identify that knowledge in technology is considered to be of value if it allows for a technological outcome to function successfully

INDICATORS OF ACHIEVEMENT

Students can:

- describe examples to illustrate how social and/or environmental issues have influenced the technological practice undertaken.
- explain why particular technological outcomes have changed over time
- describe examples to illustrate how technological developments have changed society over time
- describe examples to illustrate how technological developments have changed physical environments over time
- explain that technological knowledge is evaluated in terms of how effective it is in supporting an outcome to function successfully

Characteristics of Technological Outcomes

ACHIEVEMENT OBJECTIVE

Students will:

Understand that technological outcomes are recognisable as fit for purpose by the relationship between their physical and functional natures.

TEACHER GUIDANCE

To support students to develop understanding of characteristics of technological outcomes at level 3, teachers could:

- provide students with a description of a need or opportunity for a potential technological outcome and other details related to its use. These details should include such things as purpose, intended users and the environment in which it is to be situated. Support students to generate potential options for the outcome's physical nature and functional nature and to explain which of these could be justified as fit for purpose.
- provide students with the opportunity to examine a range of technological outcomes with similar functional natures but with different physical natures and support them to understand that the intended use will determine which physical nature will be fit for purpose. For example, a selection of brooms could be described as having a similar functional nature (to sweep) but whether they are to sweep dust of the kitchen floor or water off the driveways will necessitate a different physical nature.
- provide students with the opportunity to examine a range of technological outcomes with similar physical natures but with different functional natures. For example, a selection of brushes could be described as having similar physical natures (all have flexible bristles) but the way in which they are used will determine their functional nature as to whether they function to clean, act as a reservoir to spread a substance, or to separate something.
- guide students to understand the relationship between the physical and functional nature in a technological outcome. That is, the functional nature requirements set boundaries around the suitability of proposed physical nature options, and the physical nature options will set boundaries around what functional nature is feasible for a technological outcome at any time.

INDICATORS OF ACHIEVEMENT

Students can:

- describe possible physical and functional nature options for a technological outcome when provided with a need or opportunity
- describe examples of technological outcomes with different physical natures that have similar functional natures
- describe examples of technological outcomes with different functional natures that have similar physical natures
- explain the relationship between the physical and functional nature of selected technological outcomes.

NATURE OF TECHNOLOGY: INDICATORS OF PROGRESSION

LEVEL FOUR

Teachers should establish if students have developed robust level three understandings and are ready to begin working towards level three achievement objectives for the nature of technology and plan learning experiences to progress these as guided by the level three Indicators of Achievement below.

Characteristics of Technology

ACHIEVEMENT OBJECTIVE

Students will:

Understand how technological development expands human possibilities and how technology draws on knowledge from a wide range of disciplines.

TEACHER GUIDANCE

To support students to develop understanding of characteristics of technology at level 4, teachers could:

- provide students with opportunities to examine a range of technological developments that have and/or could expand human possibilities by changing people's sensory perception and/or physical abilities. Examination of technological developments should allow students to gain insight into how decisions are based on what could and what should happen.
- support students to understand that expanding human possibilities can result in positive and negative impacts for particular groups of people, and the wider social and natural environment
- provide students with opportunities to examine and debate examples of innovative technological developments that resulted in new possibilities. Examples should draw from the past and present and allow students to identify the creative and critical thinking that underpinned the developments, and how what could happen and what should happen were considered.
- support students to analyse a range of examples of technological developments and to identify the knowledge and skills that informed design decisions. Examples should be drawn from within their own and others' technological practice and allow students to gain insight into the range of disciplines that can support technological developments

INDICATORS OF ACHIEVEMENT

Students can:

- describe examples to illustrate how technological developments have expanded or have the potential to expand human possibilities and discuss the possible short and long term impacts of this
- discuss examples of innovative technological development to illustrate the role of creative and critical thinking
- identify the knowledge and skills that have informed design decisions in particular technological developments

Characteristics of Technological Outcomes

ACHIEVEMENT OBJECTIVE

Students will:

Understand that technological outcomes can be interpreted in terms of how they might be used and by whom and that each has a proper function as well as possible alternative functions.

TEACHER GUIDANCE

To support students to develop understanding of characteristics of technological outcomes at level 4, teachers could:

- provide students with the opportunity to explore examples of technological outcomes and support them to identify their proper function. Proper function can be determined from an analysis of both the design intent that drove the outcome's development as well as how it is most commonly used
- provide students with examples of technological outcomes where the proper function of a technological outcome has changed over time because an alternative use was successful and then became socially accepted as the norm
- provide students with examples of technological outcomes that have been used unsuccessfully for other purposes and/or in different environments and support them to identify the impacts. Impacts may be in terms of the outcome, the user, and /or the social and physical environment

INDICATORS OF ACHIEVEMENT

Students can:

- explain the proper function of existing technological outcomes
- describe examples that illustrate technological outcomes that have been successfully used by end-users for purposes other than what they were originally designed for
- describe examples that illustrate technological outcomes that have been unsuccessfully used by end-users for purposes other than what they were originally designed and discuss the impacts of this

LEVEL FIVE

Teachers should establish if students have developed robust level four understandings and are ready to begin working towards level five achievement objectives for the nature of technology and plan learning experiences to progress these as guided by the level five Indicators of Achievement below.

Characteristics of Technology

ACHIEVEMENT OBJECTIVE

Students will:

Understand how people's perceptions and acceptance of technology impact on technological developments and how and why technological knowledge becomes codified.

TEACHER GUIDANCE

To support students to develop understanding of characteristics of technology at level 5, teachers could:

- support students to analyse a range of examples of technological developments to examine people's perceptions and/or level of acceptance has influenced the developments. Examples should be drawn from past, present and possible future technological developments to allow students to gain insight into the influence that perceptions and past experiences have on the acceptance of existing and future technological practice and outcomes
- support students to analyse a range of examples of technological developments and to identify codified technological knowledge that was used to inform design and production decisions. Codified technological knowledge refers to such things as codes of practice, codes of ethics, intellectual property codes, codes of standards, material tolerances etc. Examples should be drawn from within their own and others' technological practice
- provide students with opportunities to discuss the role of codified knowledge in technology and understand why and how particular knowledge becomes codified. Codified knowledge serves to remind technologists of their responsibilities and provide them with access to established knowledge and procedures that have been shown to support successful technological development in the past. In this way codified knowledge can be used to provide constructional, ethical and/or legal compliance constraints on contemporary technological developments. Technological knowledge becomes codified when technological experts consider they have adequate evidence to validate it.
- support students to understand how established codified knowledge can be challenged and that ongoing revision is important due to the changing made, social and natural world. For example, the development of new materials, tools, and/or techniques, shifting social, political and environmental needs and understandings, and technological outcome malfunction, can all serve to challenge existing codified knowledge.

INDICATORS OF ACHIEVEMENT

Students can:

- explain how people's perception of and experiences with past technological developments (both in terms of practice and technological outcomes) influences their acceptance of technology
- explain how people's perception of and experiences with past technological developments (both in terms of practice and technological outcomes) impacts on future technological developments
- identify examples of codified technological knowledge and explain its role in particular technological developments
- explain how and why technological knowledge becomes codified

Characteristics of Technological Outcomes

ACHIEVEMENT OBJECTIVE

Students will:

Understand that technological outcomes are fit for purpose in terms of time and context. Understand the concept of malfunction and how "failure" can inform future outcomes.

TEACHER GUIDANCE

To support students to develop understanding of characteristics of technological outcomes at level 5, teachers could:

- support students to analyse a range of examples of how technological outcomes have been evaluated as fit for purpose according to its appropriateness to the time and context of its development. Examples should be drawn from within students own and others' technological practice and allow students to examine the criteria used to make the judgment.
- support students to explore a range of examples of technological outcome failure and support them identify those that are examples of malfunction. Malfunction refers to a single event failure of a technological outcome as opposed to failure due to 'wear' or reaching the end of the designed lifespan.
- support students to analyse examples of technological outcome malfunction to gain insight into how such events can inform decisions about the future of the outcome. Decisions may be made to withdraw or modify the technological outcome or retain the outcome with modified operational parameters.

INDICATORS OF ACHIEVEMENT

Students can:

- explain why time and context are important criteria for judging the fitness for purpose of technological outcomes
- determine if particular past technological outcomes would be considered fit for purpose if developed today
- explain what is meant by the malfunction of technological outcomes and how such failures can inform future outcomes
- explain the cause of particular technological outcome malfunction and the resulting consequences

LEVEL SIX

Teachers should establish if students have developed robust level five understandings and are ready to begin working towards level six achievement objectives for the nature of technology and plan learning experiences to progress these as guided by the level six Indicators of Achievement below.

Characteristics of Technology

ACHIEVEMENT OBJECTIVE

Students will:

Understand the interdisciplinary nature of technology and the implications of this for maximising possibilities through collaborative practice.

TEACHER GUIDANCE

To support students to develop understanding of characteristics of technology at level 6, teachers could:

- support students to analyse a range of examples of interdisciplinary technological developments and identify the impact the interdisciplinary nature had on the technological practice undertaken. Examples should be drawn from within student own and others' technological practice and allow students to gain insight into the way disciplines have been combined to support technological practice
- support students to identify examples of where collaborative work between technologists and/or other people has led to new possibilities for technological practice and/or outcome design. Examples should be drawn from within students own and others' technological practice and allow students to gain insight into the way idea generation and exploration can be enhanced through collaboration.
- ensure students understand that interdisciplinary collaboration provides exciting opportunities to 'work at the boundaries' of established fields, however this may cause situations where no codified technological knowledge exists to guide practice, tensions between people may arise, and unknown consequences may result

INDICATORS OF ACHIEVEMENT

Students can:

- explain examples of technological developments that are interdisciplinary in nature to demonstrate how the range of disciplines involved impacted on the technological practice
- explain examples of technological developments to demonstrate how collaborative practices of technologists have enhanced and/or inhibited technological developments

Characteristics of Technological Outcomes

ACHIEVEMENT OBJECTIVE

Students will:

Understand that some technological outcomes can be perceived as both product and system. Understand how these outcomes impact on other outcomes and practices and on people's views of themselves and possible futures.

TEACHER GUIDANCE

To support students to develop understanding of characteristics of technological outcomes at level 6, teachers could:

- provide students with opportunity to describe particular technological outcomes as a product and a system and support them to understand that the categorization of product or system is not an inherent property of the outcome, but rather how it is perceived by people in order to analyse and understand it.
- ensure students understand that if a technological outcome is identified as a product, the focus for describing its physical nature will be on the materials it is made from. If a technological outcome is identified as system, the focus for describing its physical nature will be on the components within it and how they are connected.
- support students to identify examples of socio-technological environments to examine how technological outcomes (products and systems) and non-technological entities and systems (people, natural environments, political systems etc) work together to ensure the environment is successful. Examples should be drawn from past, present and possible future socio-technological environments. Socio-technological environments include such things as communication networks, hospitals, transport systems, waste disposal, recreational parks, factories, power plant etc.

INDICATORS OF ACHIEVEMENT

Students can:

- explain that some technological outcomes can be perceived as both a product and a system
- describes examples to illustrate how technological outcomes and non-technological entities and systems work together to create socio-technological environments

NATURE OF TECHNOLOGY: INDICATORS OF PROGRESSION

LEVEL SEVEN

Teachers should establish if students have developed robust level six understandings and are ready to begin working towards level seven achievement objectives for the nature of technology and plan learning experiences to progress these as guided by the level seven Indicators of Achievement below.

Characteristics of Technology

ACHIEVEMENT OBJECTIVE

Students will:

Understand the implications of ongoing contestation and competing priorities for complex and innovative decision making in technological development.

TEACHER GUIDANCE

To support students to develop understanding of characteristics of technology at level 7, teachers could:

- support students to critically analyse examples of technological practice to gain insight into how technologists identify and deal with contestable issues and competing priorities. Examples should allow students access to such things as how changing attitudes, values and ethics, new and/or different knowledge and materials, impact on technologists' decision making
- support students to understand technology as a field of on-going contestation and competing priorities that require resolution through complex decision making and balancing of resources against stakeholder needs and desires
- guide students to recognise the role of functional and practical reasoning in complex decision making
- support students to critically analyse examples of innovative technological developments. Examples should draw from the past and present and allow students to gain insight into how informed creativity, critical evaluation and the pushing of boundaries allows for innovative decision making and resulting in innovative outcomes

INDICATORS OF ACHIEVEMENT

Students can:

- explain technology as a field of on-going contestation and competing priorities and explain how this impacts on technological development
- describe examples to demonstrate how critical evaluation, informed creativity and boundary pushing impacts on innovative technological practice and/or technological outcomes

Characteristics of Technological Outcomes

ACHIEVEMENT OBJECTIVE

Students will:

Understand that technological outcomes are a resolution of form and function priorities and that malfunction affects how people view and accept outcomes.

TEACHER GUIDANCE

To support students to develop understanding of characteristics of technological outcomes at level 7, teachers could:

- support students to critically analyse the physical and functional nature of technological outcomes to identify what design elements have been prioritised. Support students to discuss why these prioritisation decisions may have been made with respect to the intended purpose of the technological outcome, the context of its use and the time of its development.
- support students to analyse examples of technological outcome malfunction to gain insight into how such events can impact on future decision making in technology. Impacts can include such things as the decision to withdraw or modify the technological outcome, or retain the outcome with modified operational parameters. Wider impacts may also result, such as changes to codified knowledge and influences on the development of related technological outcomes

INDICATORS OF ACHIEVEMENT

Students can:

- discuss examples of technological outcomes to demonstrate how design elements have been prioritised and why these decisions enabled it to be fit for purpose
- describe examples of technological outcome malfunction to demonstrate how malfunction can impact on subsequent technological developments

LEVEL EIGHT

Teachers should establish if students have developed robust level seven understandings and are ready to begin working towards level eight achievement objectives for the nature of technology and plan learning experiences to progress these as guided by the level eight Indicators of Achievement below.

Characteristics of Technology

ACHIEVEMENT OBJECTIVE

Students will:

Understand the implications of technology as intervention by design and how interventions have consequences, known and unknown, intended and unintended.

TEACHER GUIDANCE

To support students to develop understanding of characteristics of technology at level 8, teachers could:

- support students to critically analyse examples of technological developments and their consequences (known and unknown, intended and unintended), to gain insight into the social responsibility technologists have due to the interventionist nature of technology. Examples should allow students to gain insight into how technology has real and long term impacts for the made, natural and social world. Students should be supported to discuss the implications this has for technologists' collective responsibility
- support students to understand that technology can challenge people's views of what it is to be 'human'. Contexts for exploration could include contemporary developments in the area of communication technologies, artificial intelligence, human-robotic interfaces, second-life gaming, genetic engineering, nanotechnology etc)
- ensure students explore and discuss such things as the ethics of designing for limited technological outcome lifespan, designing to comply with minimal engineering ideals, utilizing and developing sustainable materials, reducing energy consumption and waste, developing and managing socio-technological environments etc.

INDICATORS OF ACHIEVEMENT

Students can:

- discuss technology as intervention by design and use examples to demonstrate the impacts and implications of this
- describe examples to demonstrate how technology can challenge people's views of what it is to be 'human'

Characteristics of Technological Outcomes

ACHIEVEMENT OBJECTIVE

Students will:

Understand how technological outcomes can be interpreted and justified as fit for purpose in their historical, cultural, social, and geographical locations.

TEACHER GUIDANCE

To support students to develop understanding of characteristics of technological outcomes at level 8, teachers could:

- support students to critically analyse a range of technological developments to interpret the fitness for purpose, in its broadest sense, of technological outcomes. The interpretation will be based on the physical and functional nature of the outcome, the historical, cultural, social, and geographical location of the final outcome as well as its development, and any information available regarding its performance over time.
- ensure students understand that fitness for purpose in its broadest sense refers to the 'fitness' of the outcome itself as well as the practices used to develop the outcome (eg, such things as the sustainability of resources used, ethical nature of testing practices, cultural appropriateness of trialing procedures, determination of lifecycle and ultimate disposal).

INDICATORS OF ACHIEVEMENT

Students can:

- interpret the fitness for purpose, in its broadest sense, of existing technological outcomes and provide justification of the interpretation

TECHNOLOGICAL KNOWLEDGE: INDICATORS OF PROGRESSION

LEVEL ONE

Teachers should establish if students hold any misconceptions or partial understandings that would inhibit students meeting the level one achievement objectives for technological knowledge and plan learning experiences to challenge and/or progress these as guided by the level one Indicators of Achievement below.

Technological Modelling

ACHIEVEMENT OBJECTIVE

Students will:

Understand that functional models are used to represent reality and test design concepts and that prototypes are used to test technological outcomes.

TEACHER GUIDANCE

To support students to develop understanding of technological modelling at level 1, teachers could:

- guide students to understand that functional models are representations of potential technological outcomes and that they can take many forms (eg, thinking, talking, drawing, physical mock-ups, computer aided simulations etc)
- provide students with the opportunity to interact with a variety of functional models and guide them to identify that the common purpose of functional modelling is to test design concepts. Design concepts include design ideas for parts of an outcome as well as a complete conceptual design for the outcome as a whole
- guide students to understand that a prototype is the first version of the fully completed technological outcome
- provide students with a range of prototyping examples and guide them to identify that the common purpose of prototyping is to test the outcome

INDICATORS OF ACHIEVEMENT

Students can:

- describe what a functional model is
- identify the purpose of functional modelling
- describe what a prototype is
- identify the purpose of prototyping

Technological Products

ACHIEVEMENT OBJECTIVE

Students will:

Understand that technological products are made from materials that have performance properties.

TEACHER GUIDANCE

To support students to develop understanding of technological products at level 1, teachers could:

- provide students with a range of technological products to explore and guide them to identify the materials they are made from
- provide students with the opportunity to explore common materials and guide them to determine what the materials can do and how they can be manipulated
- guide students to use knowledge of materials to suggest why a material would be selected for use in a particular product, and how it has been shaped, joined and/or finished to make the product

INDICATORS OF ACHIEVEMENT

Students can:

- identify materials that technological products are made from
- suggest why the materials used in particular technological products were selected
- identify that materials have been shaped, joined and/or finished to make a technological product

Technological Systems

ACHIEVEMENT OBJECTIVE

Students will:

Understand that technological systems have inputs, controlled transformations, and outputs.

TEACHER GUIDANCE

To support students to develop understanding of technological systems at level 1, teachers could:

- provide students with a range of technological systems to explore and guide them to identify system components and how they are connected
- Guide students to identify the inputs and outputs of technological systems and recognise that a controlled transformation has occurred

INDICATORS OF ACHIEVEMENT

Students can:

- identify the components of a technological system and how they are connected.
- identify the input/s and output/s of particular technological systems.
- Identify that a system transforms an input to an output

LEVEL TWO

Teachers should establish if students have developed robust level one understandings and are ready to begin working towards level two achievement objectives for technological knowledge and plan learning experiences to progress these as guided by the level two Indicators of Achievement below.

Technological Modelling

ACHIEVEMENT OBJECTIVE

Students will:

Understand that functional models are used to explore, test, and evaluate design concepts for potential outcomes and that prototyping is used to test a technological outcome for fitness of purpose.

TEACHER GUIDANCE

To support students to develop understanding of technological modelling at level 2, teachers could:

- provide students with the opportunity to interact with a variety of functional models and support them to identify the design concept being tested and if it related to the physical and/or functional nature of the potential outcome. Design concepts include design ideas for parts of an outcome as well as a complete conceptual design for the outcome as a whole
- provide students with examples of evaluations from prototyping and support them to identify whether the technological outcome tested was fit for purpose
- guide students to reflect on the role of functional modelling and prototyping to develop an understanding of the importance of both in technological development

INDICATORS OF ACHIEVEMENT

Students can:

- explain that the purpose of functional modelling of design ideas allows for the gathering of specific information about the possible nature of a potential technological outcome
- describe examples to illustrate how functional modelling has been used to test design ideas and develop conceptual designs
- describe examples to illustrate how prototyping has been used to test technological outcomes
- discuss the importance of functional modelling and prototype testing in the development of technological outcomes

Technological Products

ACHIEVEMENT OBJECTIVE

Students will:

Understand that there is a relationship between a material used and its performance properties in a technological product.

TEACHER GUIDANCE

To support students to develop understanding of technological products at level 2, teachers could:

- provide students with the opportunity to research and experiment with a range of materials and guide them to identify their performance properties. Performance properties of materials refer to such things as conductivity, water resistance, warmth, texture, flexibility etc.
- provide students with a variety of technological products and guide them to identify the performance properties particular materials provides for that product.

INDICATORS OF ACHIEVEMENT

Students can:

- describe the performance properties of particular materials
- identify the performance properties of materials used in particular technological products

Technological Systems

ACHIEVEMENT OBJECTIVE

Students will:

Understand that there are relationships between the inputs, controlled transformations, and outputs occurring within simple technological systems.

TEACHER GUIDANCE

To support students to develop understanding of technological systems at level 2, teachers could:

- provide students with a range of simple technological systems to explore and guide them to understand the role of each component and to identify the changes that are occurring in the transformation process. Simple technological systems are defined as systems that have been designed to change inputs to outputs through a single transformation process.
- guide students to understand that sometimes transformation processes may be difficult to determine or understand and these can be represented as a 'black box'. That is, a black box is described as a way of depicting a part of a system where the inputs and outputs are known but the transformation process is not known

INDICATORS OF ACHIEVEMENT

Students can:

- describe the change that has occurred to the input to produce the output in simple technological systems
- identify the role each component has in allowing the inputs to be transformed into outputs within simple technological systems

LEVEL THREE

Teachers should establish if students have developed robust level two understandings and are ready to begin working towards level three achievement objectives for technological knowledge and plan learning experiences to progress these as guided by the level three Indicators of Achievement below.

Technological Modelling

ACHIEVEMENT OBJECTIVE

Students will:

Understand that different forms of functional modelling are used to inform decision making in the development of technological possibilities and that prototypes can be used to evaluate the fitness of technological outcomes for further development.

TEACHER GUIDANCE

To support students to develop understanding of technological modelling at level 3, teachers could:

- provide students with the opportunity to explore a range of examples of functional modelling and support students to gain insight into the different types of evidence that can be generated and to explore the impact that the media used can have on the way evidence is generated
- support student discussion of how functional modelling informs decision making and guide them to identify the benefits and limitations of functional modelling in examples provided. Benefits include such things as reducing the risk of wasting time, money and materials. Limitations arise due to the representational nature of modelling. That is, what is being tested is necessarily partial and therefore prototyping is required to fully test the outcome
- provide students with the opportunity to explore a range of examples of prototyping to gain insight into how appropriate evidence can be gained to evaluate a technological outcome's fitness for purpose and establish if there is a need for any further development.

INDICATORS OF ACHIEVEMENT

Students can:

- explain that different forms of modelling provide different types of evidence.
- discuss examples to illustrate how particular models were developed to gather specific data to inform decision making
- identify the benefits and limitations of functional modelling undertaken in particular examples
- describe examples to illustrate how prototypes were tested to evaluate a technological outcome's fitness for purpose and to identify any need for further development

Technological Products

ACHIEVEMENT OBJECTIVE

Students will:

Understand the relationship between the materials used and their performance properties in technological products.

TEACHER GUIDANCE

To support students to develop understanding of technological products at level 3, teachers could:

- provide students with the opportunity to research and experiment with a range of materials and support students to develop understandings of why materials have particular performance properties. These understandings will based on the combination of a material's structural (conductive, ductile etc) and sensory (colour, texture etc) qualities.
- provide students with a variety of technological products and support them to investigate how the materials used in the product combine to allow the product to function as designed.
- provide students with a range of technological products with unknown functions and support them to make informed suggestions for possible function.

INDICATORS OF ACHIEVEMENT

Students can:

- identify the structural and sensory qualities of particular materials and how these combine to provide the performance properties of the materials
- explain how all the materials used in a technological product work together to allow the product to function as designed.
- suggest possible functions of a technological product based on an understanding of the materials used in its construction.

Technological Systems

ACHIEVEMENT OBJECTIVE

Students will:

Understand that technological systems are represented by symbolic language tools and understand the role played by the "black box" in technological systems.

TEACHER GUIDANCE

To support students to develop understanding of technological systems at level 3, teachers could:

- provide students with the opportunity to investigate a range of technological systems and guide them to understand that technological systems do not require further human design decision making during the transformation process for the inputs to be transformed to outputs. That is, a technological system will produce particular outputs in an automated fashion once the inputs have initiated the transformation process
- provide examples of technological systems that contain unknown transformation processes (black boxes) and support students to understand the role these play in terms of the advantages and/or disadvantages for developers and users.
- provide students with examples of how technological systems can be represented and guide students to interpret the specialised language and symbol conventions used.
- provide students with opportunity to use specialised language and symbol conventions to represent technological systems to others

INDICATORS OF ACHIEVEMENT

Students can:

- describe what a 'black box' is within a technological system
- identify possible advantages and disadvantages of having black boxed transformations within particular technological systems
- describe technological systems using specialised language and symbol conventions

TECHNOLOGICAL KNOWLEDGE: INDICATORS OF PROGRESSION

LEVEL FOUR

Teachers should establish if students have developed robust level three understandings and are ready to begin working towards level four achievement objectives for technological knowledge and plan learning experiences to progress these as guided by the level four Indicators of Achievement below.

Technological Modelling

ACHIEVEMENT OBJECTIVE

Students will:

Understand how different forms of functional modelling are used to explore possibilities and to justify decision making and how prototyping can be used to justify refinement of technological outcomes.

TEACHER GUIDANCE

To support students to develop understanding of technological modelling at level 4, teachers could:

- support student discussion about the importance of using modelling to explore whether an outcome should be developed as well as whether it could be developed
- support students to examine examples of extensive and diverse functional modelling practices used to support particular technological developments – both within their own and other's technological practice.
- guide students to gain insight into how design decisions are justified with regards to both feasibility and acceptability. Such justifications will rely on the synthesis of evidence gained from diverse forms of modelling seeking multiple perspectives.
- support students to identify and examine examples of prototyping from both within their own and other's technological practice.
- support students to gain insight from examples of how evidence gained can used to justify an evaluation of a technological outcome's fitness for purpose or its requirement for further development.

INDICATORS OF ACHIEVEMENT

Students can:

- explain why it is necessary to consider both what 'can' be done and what 'should' be done when making design decisions
- explain why different forms of functional modelling are needed to fully explore possibilities and gather different types of data
- discuss examples of prototyping to explain how evidence gathered provided justification for evaluating a technological outcome as fit for purpose or in need of refinement

Technological Products

ACHIEVEMENT OBJECTIVE

Students will:

Understand that materials can be formed, manipulated, and/or transformed to enhance the fitness for purpose of a technological product.

TEACHER GUIDANCE

To support students to develop understanding of technological products at level 4, teachers could:

- provide students with the opportunity to research and experiment with a range of materials and support students to develop understandings of how materials have been formed, manipulated and/or transformed in ways to enhance the fitness for purpose of particular technological products over time.
- ensure students understand that 'forming' refers to how materials can be shaped (cut, molded, bent, carved etc) to the 'form' required for use in the product, and manipulating and transforming refers to how materials can be joined and/or 'finished' in ways that change their performance properties.

INDICATORS OF ACHIEVEMENT

Students can:

- describe examples to illustrate how a technological product's fitness for purpose was enhanced by the way a material was shaped
- describe examples to illustrate how a technological product's fitness for purpose was enhanced by the way a material was joined with other materials
- describe examples to illustrate how a technological product's fitness for purpose was enhanced by the way a material was finished

Technological Systems

ACHIEVEMENT OBJECTIVE

Students will:

Understand how technological systems employ control to allow for the transformation of inputs to outputs.

TEACHER GUIDANCE

To support students to develop understanding of technological systems at level 4, teachers could:

- provide students with the opportunity to investigate a range of technological systems and support them to identify how transformation processes are controlled.
- support students to understand that control mechanisms can work to in ways to enhance the fitness for purpose of technological systems by maximising the desired outputs and minimising the undesirable outputs.

INDICATORS OF ACHIEVEMENT

Students can:

- explain how processes are controlled to enable the inputs to be transformed to outputs
- describe examples to illustrate how a technological system's fitness for purpose was enhanced by the use of control mechanisms.

LEVEL FIVE

Teachers should establish if students have developed robust level four understandings and are ready to begin working towards level five achievement objectives for technological knowledge and plan learning experiences to progress these as guided by the level five Indicators of Achievement below.

Technological Modelling

ACHIEVEMENT OBJECTIVE

Students will:

Understand how evidence, reasoning, and decision making in functional modelling contribute to the development of design concepts and how prototyping can be used to justify ongoing refinement of technological outcomes.

TEACHER GUIDANCE

To support students to develop understanding of technological modelling at level 5, teachers could:

- ensure students understand that informed and justifiable decision making relies on reasoning and evidence.
- support students to examine examples of extensive and diverse functional modelling practices used to support particular technological developments – both within their own and other's technological practice.
- support students to gain insight from examples into how design decisions are justified with regards to both feasibility and acceptability. Such justifications will rely on the synthesis of evidence gained from diverse forms of modelling seeking multiple perspectives.
- support students to identify and examine examples of prototyping from both within their own and others technological practice.
- support students to gain insight from examples into how testing procedures can provide information regarding maintenance requirements of a technological outcome. Maintenance requirements involve addressing environmental influences on, and/or ongoing refinements of, the technological outcome.

INDICATORS OF ACHIEVEMENT

Students can:

- discuss examples to illustrate how evidence and reasoning is used in informed and justifiable decision making during functional modelling.
- discuss examples to illustrate how prototyping provides information to determine maintenance requirements to ensure optimal performance over time.

Technological Products

ACHIEVEMENT OBJECTIVE

Students will:

Understand how materials are selected, based on desired performance criteria.

TEACHER GUIDANCE

To support students to develop understanding of technological products at level 5, teachers could:

- support students to examine examples of how materials have been selected to ensure the fitness for purpose of particular technological products – both within their own and other's technological practice.
- support students to use examples to gain insight into how selecting an appropriate material relies on understanding the composition of materials. The composition of materials relates to such things as the type and arrangements of particles that make up the material.
- ensure students understand that for materials to be selected for use in a technological product, their particular performance properties must align with the desired performance specifications of that product.

INDICATORS OF ACHIEVEMENT

Students can:

- describe examples to illustrate how the performance specifications of technological products determine the performance properties required of materials that might be suitable for the product's construction
- discuss examples to illustrate how decisions about material selection take into account the composition of the material

Technological Systems

ACHIEVEMENT OBJECTIVE

Students will:

Understand the properties of subsystems within technological systems.

TEACHER GUIDANCE

To support students to develop understanding of technological systems at level 5, teachers could:

- provide students with the opportunity to investigate a range of technological systems that contain one or more subsystems both from within their own and other's technological practice.
- support students to identify subsystems within technological systems and describe them in terms of their properties. The property of a subsystem refers to the role it provides in the technological system as a whole and can be established by examining what has happened to the input to become the output at the subsystem stage.
- support students to understand that interfaces between subsystems have an important role in enabling the technological system to work effectively as a whole.

INDICATORS OF ACHIEVEMENT

Students can:

- identify subsystems within technological systems and explain their properties.
- discuss examples to illustrate how interfaces between subsystems support the way the technological system works.

LEVEL SIX

Teachers should establish if students have developed robust level five understandings and are ready to begin working towards level six achievement objectives for technological knowledge and plan learning experiences to progress these as guided by the level six Indicators of Achievement below.

Technological Modelling

ACHIEVEMENT OBJECTIVE

Students will:

Understand the role and nature of evidence and reasoning when managing risk through technological modelling.

TEACHER GUIDANCE

To support students to develop understanding of technological modelling at level 6, teachers could:

- guide students to understand the concept of risk as it relates to reducing instances of malfunctioning of technological outcomes, and/or increasing levels of outcome robustness
- support students to examine examples of technological modelling to understand how risk is explored and identified within particular technological developments
- guide students to understand practical and functional reasoning
- guide students to understand how functional and practical reasoning influences technological modelling particularly in terms of identifying the focus for testing and the interpretation of evidence.
- guide students to understand how technological modelling is used to manage risk through exploring and identifying possible risk factors associated with the development of a technological outcome
- ensure students examine their own technological modelling as well as technological modelling undertaken by a other technologists

INDICATORS OF ACHIEVEMENT

Students can:

- explain practical and functional reasoning and how they work together to enhance technological modelling
- explain the role of technological modelling in the exploration and identification of possible risk/s
- describe examples to illustrate the strengths and weaknesses of technological modelling for risk exploration

Technological Products

ACHIEVEMENT OBJECTIVE

Students will:

Understand how materials are formed, manipulated, and transformed in different ways, depending on their properties, and understand the role of material evaluation in determining suitability for use in product development.

TEACHER GUIDANCE

To support students to develop understanding of technological products at level 6, teachers could:

- provide students with the opportunity to research and experiment with a range of materials to develop understandings of how their composition impacts on how they can be formed, manipulated and/or transformed.
- ensure students understand that materials can be formed, manipulated and/or transformed to enhance the fitness for purpose of a technological product. 'Forming' refers to how materials are shaped (cut, molded, bent etc) to the 'form' required for use in the product. Manipulating and transforming refers to how materials are joined and/or finished in ways that change their performance properties.
- support students to examine examples of how materials have been evaluated to ensure the fitness for purpose of particular technological products – both within their own and other's technological practice.
- support students to use examples to gain insight into how material evaluation procedures rely on understanding the composition of the materials to be evaluated and the performance criteria of a technological product.
- ensure students understand that material evaluation enables decisions to be made about how a material would support, or not, the fitness for purpose of particular technological products, and decrease the probability of a product malfunction.

INDICATORS OF ACHIEVEMENT

Students can:

explain how the composition of different materials enables them to be shaped in different ways

explain how the composition of materials determines the way it can be joined

explain how the composition of materials determine the types of 'finishing' techniques suitable for use

describe the role of material evaluation in determining material suitability for use in a technological product

Technological Systems

ACHIEVEMENT OBJECTIVE

Students will:

Understand the implications of subsystems for the design, development, and maintenance of technological systems.

TEACHER GUIDANCE

To support students to develop understanding of technological systems at level 6, teachers could:

- provide students with the opportunity to investigate a range of technological systems that contain one or more subsystems both from within their own and other's technological practice.
- support students to use examples to gain insight into how the use of subsystems can impact on system design, development and maintenance particularly in relation to the development of self-regulatory systems.
- support students to understand that subsystems can allow the design of complex technological systems where some subsystems are 'black boxed' for development and or maintenance purposes. This can result in both advantages (reduced need to understand all aspects of the system, ability to replace faulty subsystem without disrupting the entire system) and disadvantages (trouble shooting can be difficult).
- support students to understand the role of subsystems for reducing malfunction and/or system componentry damage through such things as 'back up' or 'shutdown' subsystems.

INDICATORS OF ACHIEVEMENT

Students can:

- explain the implications of using subsystems, for the design, development and maintenance of technological systems.
- describes examples to illustrate how control and/or feedback subsystems allows for the design of self-regulatory technological systems.
- describe examples to illustrate the advantages and disadvantages of subsystems employed in particular technological systems.

TECHNOLOGICAL KNOWLEDGE: INDICATORS OF PROGRESSION

LEVEL SEVEN

Teachers should establish if students have developed robust level six understandings and are ready to begin working towards evel seven achievement objectives for technological knowledge and plan learning experiences to progress these as guided by the level seven Indicators of Achievement below.

Technological Modelling

ACHIEVEMENT OBJECTIVE

Students will:

Understand how the "should" and "could" decisions in technological modelling rely on an understanding of how evidence can change in value across contexts and how different tools are used to ascertain and mitigate risk.

TEACHER GUIDANCE

To support students to develop understanding of technological modelling at level 7, teachers could:

- support students to understand that different people and communities accept different types of evidence as valid. That is, the status given to evidence is dependent on a range of factors including ethical views and the perceived authority of people involved in the presentation of the evidence
- support students to understand how the context impacts on how valid evidence is perceived to be. This means that shifting from one context to another can change the status of the evidence provided by technological modelling.
- support students to understand how decisions underpinning technological modelling based on what should and could happen, rely on an understanding of how evidence gained may differ in value across contexts and/or communities.
- support students to understand how technological modelling is used to ascertain and mitigate risk. Ascertaining risk involves establishing the probability of identified risks. Mitigation involves taking steps to reduce the probability of the risk being realised and/or severity of the risk should it be realised.
- support students to examine examples of technological modelling to understand how risk is ascertained and mitigated within particular technological developments.
- ensure students examine their own technological modelling as well as a technological modelling undertaken by a range of technologists.

INDICATORS OF ACHIEVEMENT

Students can:

- explain why different people accept different types of evidence as valid
- discuss examples to illustrate why the status of evidence gained from technological modelling might change across contexts
- explain the influences on decision making underpinning technological modelling that ensures both what 'should' and 'could' be done are fully explored and justified
- explain the role of technological modelling in ascertaining and mitigating risk
- describe examples to illustrate the strengths and weaknesses of technological modelling for risk mitigation

Technological Products

ACHIEVEMENT OBJECTIVE

Students will:

Understand the concepts and processes employed in materials evaluation and the implications of these for design, development, maintenance, and disposal of technological products.

TEACHER GUIDANCE

To support students to develop understanding of technological products at level 7, teachers could:

- support students to identify and examine examples of how materials have been evaluated to allow material selection decisions that maximize the potential fitness for purpose of particular technological products.
- ensure students understand that material evaluation enables decisions to be made about what material would be optimal to ensure the fitness for purpose of particular technological products.
- ensure students understand that concepts and processes employed in evaluating a material are related to the composition, the required performance properties of the material and an understanding of the context within which the technological product will be situated
- support students to use examples to gain insight into how material evaluation procedures can be used to identify maintenance and disposal implications and inform design and development decisions.

INDICATORS OF ACHIEVEMENT

Students can:

- explain the concepts and processes that underpin the evaluation of a particular material.
- describe examples to illustrate how materials have been evaluated to determine their suitability for specific products and the environments in which they are situated.

Technological Systems

ACHIEVEMENT OBJECTIVE

Students will:

Understand the concepts of redundancy and reliability and their implications for the design, development, and maintenance of technological systems.

TEACHER GUIDANCE

To support students to develop understanding of technological systems at level 7, teachers could:

- support students to identify and examine a range of technological systems both from within their own and other's technological practice.
- support students to understand the concepts of redundancy and reliability.
- support students to use examples to gain insight into issues associated with how redundancy and reliability have impacted on system design, development and maintenance.

INDICATORS OF ACHIEVEMENT

Students can:

- explain the concept of redundancy and the implications for the design, development, and maintenance of technological systems.
- explain the concept of reliability and the implications for the design, development and maintenance of technological systems.

LEVEL EIGHT

Teachers should establish if students have developed robust level seven understandings and are ready to begin working towards level eight achievement objectives for technological knowledge and plan learning experiences to progress these as guided by the level eight Indicators of Achievement below.

Technological Modelling

ACHIEVEMENT OBJECTIVE

Students will:

Understand the role of technological modelling as a key part of technological development, justifying its importance on moral, ethical, sustainable, cultural, political, economic, and historical grounds.

TEACHER GUIDANCE

To support students to develop understanding of technological modelling at level 8, teachers could:

- support students to develop a critical and informed understanding of why technological modelling is an important aspect for ensuring responsible and defensible technological development
- ensure students examine examples of technological modelling that involve a range of competing and contestable factors to gain insight into how these factors can be handled. These factors arise from such things as differing moral, ethical, cultural, and/or political views and the way in which people adhere to and understand issues such as sustainability, globalisation, democracy, global warming etc.
- ensure students examine their own technological modelling as well as a technological modelling undertaken by a range of technologists.

INDICATORS OF ACHIEVEMENT

Students can:

- explain the critical role of technological modelling in making informed, responsive and defensible design and development decisions within technological developments.
- describe examples to illustrate how technological modelling has allowed for justifiable and defensible technological practice that takes account of often competing and contestable factors.

Technological Products

ACHIEVEMENT OBJECTIVE

Students will:

Understand the concepts and processes employed in materials development and evaluation and the implications of these for design, development, maintenance, and disposal of technological products.

TEACHER GUIDANCE

To support students to develop understanding of technological products at level 8, teachers could:

- support students to identify and examine examples of material innovation including past and contemporary examples.
- ensure students understand that material innovation can refer to both the development of a new material, or the use of an existing material in a 'new' way.
- support students to use examples to gain insight into how material innovation and evaluation procedures are used to address performance, maintenance and disposal implications and inform design and development decisions.
- support students to understand the implications for the evaluation of innovative materials whereby new procedures may need to be developed and codes established.
- ensure students understand that material evaluation enables decisions to be made about how a material would support, or not, the fitness for purpose in of particular technological products.
- ensure students understand that concepts and processes employed in material innovation and evaluation are related to composition, the required performance properties of the material and an understanding of the context within which the technological product will be situated.

INDICATORS OF ACHIEVEMENT

Students can:

- explain the concepts and processes that underpin an identified material innovation and its evaluation.
- describe examples to illustrate how material innovations have been evaluated to determine their suitability for specific products and the environments in which they are situated.
- discuss examples of past material innovations and explain how these impacted on subsequent technological development.
- discuss examples of contemporary material innovations and suggest probable implications for future technological product development.

Technological Systems

ACHIEVEMENT OBJECTIVE

Students will:

Understand operational parameters and their role in the design, development, and maintenance of technological systems.

TEACHER GUIDANCE

To support students to develop understanding of technological systems at level 8, teachers could:

- support students to identify and examine a range of technological systems both from within their own and other's technological practice.
- support students to understand operational parameters and the role these play in the design, development and maintenance of technological systems.
- support students to use examples to gain insight into operational parameters and explore how they influence and impact on system design, development and maintenance.
- support students to understand the difference between self-regulatory systems and intelligent systems. Intelligent systems have been designed to adapt to environmental inputs in ways that change the nature of the system components and/or transformation processes in known and unknown ways to produce desirable but unspecified outputs.
- provide students with the opportunity to investigate intelligent technological systems and support student to understand how the operational parameters enable these systems to function.

INDICATORS OF ACHIEVEMENT

Students can:

- explain the concepts and processes underpinning the operational parameters of particular technological systems
- explain how the establishment of operational parameters impact on the design, development and maintenance of technological systems
- discuss examples of self-regulatory and/or intelligent systems and explain how operational parameters have been developed to support such systems