Teacher Reference for Teaching Robotics

Design and Technologies
Engineering principles and systems
Investigate how forces or electrical energy can control movement, sound or light in a designed product of system (ACTDEK020)
Analyse how motion, force and energy are used to manipulate and control electromechanical systems when designing simple, engineered solutions (ACTDEK031)
Investigate and make judgments on how the characteristics and properties of materials are combined with force, motion and energy to create engineered solutions (ACTDEK043)

Elaborations
- Design and construct an autonomous robot that meets the challenge with a specific solution, giving consideration to integrating material selection with appropriate technology.
- Integration of sensors, actuators, control systems and mechanical components of a robotic solutions.

Design and Technologies
Materials and technologies specialisations
Investigate characteristics and properties of a range of materials, systems, components, tools and equipment and evaluate the impact of their use(ACTDEK023)
Analyse ways to produce designed solutions through selecting and combining characteristics and properties of materials, systems, components, tools and equipment (ACTDEK034)
Investigate and make judgments on how the characteristics and properties of materials, systems, components, tools and equipment can be combined to create designed solutions (ACTDEK046)
Investigate and make judgments, within a range of technologies specialisations, on how technologies can be combined to create designed solutions (ACTDEK047)

Elaborations
- Justifying decisions when selecting from a broad range of technologies − materials, systems, components, tools and equipment, for example selecting locally sourced materials
- Analysing and explaining the ways in which the properties and characteristics of materials have been considered in the design of a product with specific requirements such as a RCJA robot
- Investigating emerging materials and their impact on design decisions such as 3D printing

Design and Technologies
Creating designed solutions by Investigating
Critique needs or opportunities for designing, and investigate materials, components, tools, equipment and processes to achieve intended designed solutions (ACTDEP024)
Critique needs or opportunities for designing and investigate, analyse and select from a range of materials, components, tools, equipment and processes to develop design ideas (ACTDEP035)
Critique needs or opportunities to develop design briefs and investigate and select an increasingly sophisticated range of materials, systems, components, tools and equipment to develop design ideas (ACTDEP048)

Elaborations
- Identifying appropriate tools, equipment, techniques and safety procedures for each process and evaluating production processes for accuracy, quality, safety and efficiency

- Critiquing a range of design and technologies ideas, for example assessing those that draw on the intellectual property of others

Design and Technologies
Creating designed solutions by Generating
Generate, develop, communicate and document design ideas and processes for audiences using appropriate technical terms and graphical representation techniques (ACTDEP025)
Generate, develop, test and communicate design ideas, plans and processes for various audiences using appropriate technical terms and technologies including graphical representation techniques (ACTDEP036)
Apply design thinking, creativity, innovation and enterprise skills to develop, modify and communicate design ideas of increasing sophistication (ACTDEP049)

Elaborations
- Producing drawings, models and prototypes to explore design ideas, for example using technical drawing techniques, digital imaging programs, 3D printers or augmented reality modelling software; producing multiple prototypes that show an understanding of key aesthetic considerations in competing designs
- Communicating using appropriate technical terms and recording the generation and development of design ideas for an intended audience including justification of decisions, for example developing a digital portfolio with images and text which clearly communicates each step of a design process

Design and Technologies
Creating designed solutions by Producing
Apply safe procedures when using a variety of materials, components, tools, equipment and techniques to make designed solutions (ACTDEP026)
Effectively and safely use a broad range of materials, components, tools, equipment and techniques to make designed solutions (ACTDEP037)
Work flexibly to safely test, select, justify and use appropriate technologies and processes to make designed solutions (ACTDEP050)

Elaborations
- Refining technical skills and using production skills with independence to produce quality designed solutions
- Using materials, components, tools, equipment and techniques safely
- Experimenting with innovative combinations and ways of manipulating traditional and contemporary materials, components, tools, equipment and techniques, and recording findings in a collaborative space to debate the merits of each with peers
- Explaining safe working practices required for a specific classroom design project for individual or community use

Design and Technologies
Creating designed solutions by Evaluating
Negotiate criteria for success that include consideration of sustainability to evaluate design ideas, processes and solutions (ACTDEP027)
Independently develop criteria for success to assess design ideas, processes and solutions and their sustainability (ACTDEP038)
Evaluate design ideas, processes and solutions against comprehensive criteria for success recognising the need for sustainability (ACTDEP051)

Elaborations
- Establishing specific criteria for success for evaluating designed solutions
- Evaluating and justifying the use and best combination of traditional, contemporary and emerging technologies during project development
- Evaluating choices made at various stages of a design process and modifying plans when needed with consideration of criteria for success
- Reflecting on learning, evaluating processes and transferring new knowledge and skills to future design projects

Design and Technologies
Creating designed solutions by Collaborating and managing
Develop project plans that include consideration of resources when making designed solutions individually and collaboratively (ACTDEP028)
Use project management processes when working individually and collaboratively to coordinate production of designed solutions (ACTDEP039)
Develop project plans using digital technologies to plan and manage projects individually and collaboratively taking into consideration time, cost, risk and production processes (ACTDEP052)

Elaborations
- Producing, explaining and interpreting drawings; and planning production timelines using digital technologies
- Creating visual representations of a process using digital technologies to ensure efficient, safe and sustainable sequences (storyboard / flowchart / mind map)
- Establishing materials and equipment needs using digital technologies such as spreadsheets
- Collaborating to develop plans which facilitate shared responsibilities

Digital Technologies
Digital Systems
Investigate the main components of common digital systems, their basic functions and interactions, and how such digital systems may connect together to form networks to transmit data (ACTDIK014)
Investigate how data are transmitted and secured in wired, wireless and mobile networks, and how the specifications of hardware components impact on network activities (ACTDIK023)
Investigate the role of hardware and software in managing, controlling and securing the movement of and access to data in networked digital systems (ACTDIK034)

Elaborations
- Investigating the operation and use of robotic process control systems

Digital Technologies
Creating Digital Solutions by Defining
Define problems in terms of data and functional requirements, and identify features similar to previously solved problems (ACTDIP017)
Define and decompose real-world problems taking into account functional requirements and economic, environmental, social, technical and usability constraints (ACTDIP027)
Precisely define and decompose real-world problems, taking into account functional and non-functional requirements and including interviewing stakeholders to identify needs (ACTDIP038)

Elaborations
- developing a preliminary specification for an opportunity or a need that typically contains a problem statement, a set of solution needs expressed as functional and non-functional

requirements, any assumptions or constraints to be considered and the scope or boundaries of the solution

- investigating different types of functional requirements for solutions, for example increasing the speed of processing, calculating new results, improving the quality of reports
- investigating different types of non-functional requirements for solutions, for example considering how the requirements of reliability, user-friendliness, portability and robustness could affect the way people use solutions
- using software such as graphic organisers to determine a fundamental cause of a problem or to represent related elements of a problem that need to be jointly addressed in the digital solution

Digital Technologies
Creating Digital Solutions by Designing
Design, modify and follow simple algorithms represented diagrammatically and in English involving sequences of steps, branching, and iteration (repetition) (ACTDIP019)
Design algorithms represented diagrammatically and in English, and trace algorithms to predict output for a given input and to identify errors (ACTDIP029)
Design algorithms represented diagrammatically and in structured English and validate algorithms and programs through tracing and test cases (ACTDIP040)

Elaborations
- Designing algorithms to solve real-world problems and describing algorithms using flowcharts and structured English, for example START, END, IF and UNTIL
- Recognising that different algorithms can solve a problem with different trade-offs
- Tracing algorithms to predict results and program state for a given input, for example desk checking or using an interactive debugging tool
- Using tracing techniques to test algorithms, for example desk checking an algorithm for a given input by stepping through the algorithm while keeping track of contents of the variables
- Developing test cases that correspond to the requirements of the specifications, for example validating program behaviour on a range of valid and invalid user input

Digital Technologies
Creating Digital Solutions by Impementing
Implement digital solutions as simple visual programs involving branching, iteration (repetition), and user input (ACTDIP020)
Implement and modify programs with user interfaces involving branching, iteration and functions in a general-purpose programming language (ACTDIP030)
Implement modular programs, applying selected algorithms and data structures including using an object-oriented programming language (ACTDIP041)

Elaborations
- Coding separate modules that perform discrete functions but collectively meet the needs of the solution
- Defining classes that represent the attributes and behaviour of objects in the real world or in a game
- Considering different algorithms and selecting the most appropriate based on the type of problem, for example choosing appropriate algorithms for particular problems
- Selecting different types of data structures such as an array, record and object to model structured data

Digital Technologies

Creating Digital Solutions by Evaluating

Explain how developed solutions and existing information systems are sustainable and meet local community needs, considering opportunities and consequences for future applications (ACTDIP021)
Evaluate how well developed solutions and existing information systems meet needs, are innovative and take account of future risks and sustainability (ACTDIP031)
Critically evaluate how well developed solutions and existing information systems and policies take account of future risks and sustainability and provide opportunities for innovation and enterprise (ACTDIP042)

Elaborations
- Critically evaluate how a robot's software works and play for upgrades and/or improvement to better address the challenge presented

Digital Technologies

Creating Digital Solutions by Collaborating and Managing

Manage the creation and communication of ideas and information including online collaborative projects, applying agreed ethical, social and technical protocols (ACTDIP022)
Plan and manage projects, including tasks, time and other resources required, considering safety and sustainability (ACTDIP033)
Plan and manage projects using an iterative and collaborative approach, identifying risks and considering safety and sustainability (ACTDIP044)

Elaborations
- Managing and modifying the development of a solution, for example using software to record and monitor project tasks, responsibilities and timeframes and to organise continuous opportunities to review progress with collaborative partners and to conduct regular unit testing
- Developing an evolutionary prototype iteratively and incrementally, for example regularly revising features of a solution in response to testing