# Rebellious Box – WACE Curriculum Mapping

In the Rebellious Box project, students engineer an automated device that turns itself off when activated, using a servo motor to flip a switch back off. The following tables map this project against the Western Australian Curriculum (WACE), across Design & Technologies, Digital Technologies and Science, for Years 3–4, 5–6, 7–8 and 9–10.

## Design & Technologies

*The Design & Technologies content below traces how students investigate forces and energy transfer, select and justify servo and enclosure components, sketch and communicate design ideas, safely produce their Rebellious Box, and evaluate the finished device against design criteria.*

### Years 3–4

**Table 1: Design & Technologies (Years 3–4)**

| Relevant Code | Application to Project | General Capabilities |
|---|---|---|
| **WA3/4TDECEP1** – *Objects can be moved when a force is applied.* | Students investigate how the servo motor applies rotational force to move the arm that automatically closes the box lid. They observe how electrical energy is converted into mechanical motion. | • Literacy<br>• Critical & Creative Thinking |
| **WA3/4TDETS1** – *Explore how familiar technologies meet personal and community needs.* | Students investigate how automated products use sensors, motors and controllers to solve everyday problems and entertain users. | • Personal & Social Capability<br>• Critical & Creative Thinking |
| **WA3/4TDEDTID1** – *Explore the purpose for designing a solution.* | Students identify the purpose of creating an automated box that reacts to user input and discuss how automation can solve simple design challenges. | • Critical & Creative Thinking |
| **WA4TDEDTID2** – *Investigate and select resources based on their properties.* | Students select suitable servo motors, switches, Arduino boards and enclosure materials to create a reliable automated device. | • Critical & Creative Thinking |
| **WA3/4TDEDTPI1** – *Design solutions using discussion, modelling and drawings.* | Students create labelled sketches and simple diagrams showing the arrangement of electronic components before construction. | • Literacy<br>• Critical & Creative Thinking |
| **WA3/4TDEDTPI1** – *Safely use technologies and materials to produce designed solutions.* | Students safely assemble, wire and test the Rebellious Box while following workshop and electrical safety procedures. | • Personal & Social Capability<br>• Critical & Creative Thinking |
| **WA3/4TDEDTPM1** – *Share ideas and* | Students explain how their design works, discuss programming decisions and present their completed project to others. | • Literacy<br>• Personal & Social Capability |

| Relevant Code | Application to Project | General Capabilities |
|---|---|---|
| *communicate design decisions.* | | |

## Years 5–6

**Table 2: Design & Technologies (Years 5–6)**

| Relevant Code | Application to Project | General Capabilities |
|---|---|---|
| **WA5/6TDECEP1** – *Investigate how forces and energy transfer affect designed solutions.* | Students investigate how servo motors convert electrical energy into controlled movement and how mechanical linkages influence performance. | • Literacy<br>• Critical & Creative Thinking |
| **WA5/6TDETS1** – *Examine how technologies meet present and future needs.* | Students investigate how embedded systems and automation improve products used in homes, industry and everyday life. | • Personal & Social Capability<br>• Critical & Creative Thinking |
| **WA5/6TDEDTID1** – *Investigate needs or opportunities for designed solutions.* | Students define project requirements, identify design constraints and determine the functional requirements of an automated device. | • Critical & Creative Thinking |
| **WA5/6TDEDTID2** – *Investigate and select suitable materials, components and technologies.* | Students compare different actuators, switches and enclosure materials before selecting components appropriate for their design. | • Critical & Creative Thinking |
| **WA5/6TDEDTPI1** – *Develop and communicate design ideas.* | Students develop detailed sketches and annotated circuit layouts before constructing the project. | • Literacy<br>• Critical & Creative Thinking |
| **WA5/6TDEDTPI1** – *Safely produce designed solutions.* | Students assemble, wire and program their Rebellious Box using appropriate workshop procedures and electrical safety practices. | • Personal & Social Capability<br>• Critical & Creative Thinking |
| **WA5/6TDEDTPM1** – *Plan, manage and communicate production processes.* | Students organise construction stages, document testing and communicate improvements throughout development. | • Literacy<br>• Personal & Social Capability |

## Years 7–8

**Table 3: Design & Technologies (Years 7–8)**

| Relevant Code | Application to Project | General Capabilities |
|---|---|---|
| **WA7/8TDECEP1** – *Analyse how forces, motion and energy* | Students investigate how servo torque, linkage geometry and mechanical design affect the movement and reliability of the automated lid. | • Literacy<br>• Critical & Creative Thinking |

| Relevant Code | Application to Project | General Capabilities |
|---|---|---|
| *influence engineered systems.* | | |
| **WA7/8TDETS1** – *Investigate how technologies contribute to preferred futures.* | Students explore how embedded systems, automation and programmable devices improve efficiency in modern products. | • Ethical Understanding<br>• Critical & Creative Thinking |
| **WA7/8TDEDTID1** – *Investigate and define design problems.* | Students analyse user needs and engineering constraints before developing an automated solution. | • Critical & Creative Thinking |
| **WA7/8TDEDTID2** – *Investigate and select suitable resources.* | Students evaluate different servo motors, sensors, power supplies and structural materials to optimise performance. | • Critical & Creative Thinking |
| **WA7/8TDEDTID3** – *Consider available technologies, resources and components when generating solutions.* | Students justify component selection based on functionality, reliability, cost and ease of manufacture. | • Critical & Creative Thinking |
| **WA7/8TDEDTPI1** – *Develop and communicate design ideas.* | Students produce annotated engineering drawings, wiring diagrams and design documentation prior to manufacture. | • Literacy<br>• Critical & Creative Thinking |
| **WA7/8TDEDTPI1** – *Safely produce designed solutions.* | Students manufacture, assemble, wire and test an integrated electromechanical system while applying safe engineering practices. | • Personal & Social Capability |
| **WA7/8TDEDTPM1** – *Plan, manage and document production processes.* | Students manage project timelines, test prototypes and document iterative improvements throughout development. | • Literacy<br>• Personal & Social Capability |

## Years 9–10

**Table 4: Design & Technologies (Years 9–10)**

| Relevant Code | Application to Project | General Capabilities |
|---|---|---|
| **WA9/10TDECEP1** – *Analyse engineering principles including force, motion, energy and control systems.* | Students analyse how servo characteristics, mechanical loading and embedded control systems influence overall system performance and reliability. | • Literacy<br>• Critical & Creative Thinking |
| **WA9/10TDETS1** – *Evaluate the role of technologies in preferred futures.* | Students evaluate how programmable embedded systems improve automation, sustainability and product design across a range of industries. | • Ethical Understanding<br>• Critical & Creative Thinking |
| **WA9/10TDEDTID1** – *Critically investigate and* | Students develop a comprehensive engineering design brief, considering user needs, technical constraints and system requirements. | • Critical & Creative Thinking |

| Relevant Code | Application to Project | General Capabilities |
|---|---|---|
| *define complex design problems.* | | |
| **WA9/10TDEDTID3** – *Evaluate technologies, components and production processes.* | Students justify engineering decisions using evidence gathered through testing, prototyping and performance evaluation. | • Critical & Creative Thinking |
| **WA9/10TDEDTPI1** – *Safely produce and refine designed solutions.* | Students manufacture, assemble, program and refine a complete embedded electromechanical system using safe engineering practices. | • Personal & Social Capability |
| **WA9/10TDEDTE1** – *Critically evaluate designed solutions against success criteria.* | Students evaluate system reliability, maintainability, usability and efficiency, recommending evidence-based improvements for future iterations. | • Critical & Creative Thinking |

# Digital Technologies

*The Digital Technologies content below traces how students investigate the Arduino and servo as a digital system, design and implement the switch-detection algorithm, represent data digitally, and produce and evaluate their coded solution.*

## Years 3–4

**Table 5: Digital Technologies (Years 3–4)**

| Relevant Code | Application to Project | General Capabilities |
|---|---|---|
| **WA3/4DIGDS1** – *Digital systems and hardware components work together to achieve a purpose.* | Students identify the role of the Arduino, push button, servo motor, battery pack and switches, and understand how they interact as a complete automated system. | • Digital Literacy |
| **WA3/4DIGDI1** – *Represent algorithms using flowcharts including branching and repetition.* | Students design the sequence of the box's behaviour using flowcharts before programming. | • Digital Literacy |
| **WA3/4DIGDI2** – *Implement algorithms using branching and repetition.* | Students program the Rebellious Box to respond to button presses using conditional statements and loops. | • Digital Literacy |
| **WA3/4DIGDTID1** – *Define ideas and design opportunities.* | Students investigate how to make the box behave in amusing and unpredictable ways to engage the user. | • Critical & Creative Thinking |
| **WA4DIGDTID2** – *Select resources based on their properties.* | Students choose suitable electronic and mechanical components for the required movement. | • Critical & Creative Thinking |
| **WA3/4DIGDTDE1** – *Design solutions using* | Students sketch the box mechanism and annotate how each component contributes to the design. | • Critical & Creative Thinking |

| Relevant Code | Application to Project | General Capabilities |
|---|---|---|
| *labelled drawings and technical language.* | | |
| **WA3/4DIGDTPI1** – *Safely produce a designed solution.* | Students assemble, wire and test the Rebellious Box following safe workshop practices. | • Critical & Creative Thinking<br>• Personal & Social Capability<br>• Digital Literacy |
| **WA3/4DIGDTPM1** – *Communicate ideas and follow a plan.* | Students follow build instructions, collaborate with peers and manage construction time effectively. | • Literacy<br>• Personal & Social Capability |

## Years 5–6

**Table 6: Digital Technologies (Years 5–6)**

| Relevant Code | Application to Project | General Capabilities |
|---|---|---|
| **WA5/6DIGDS1** – *Investigate digital system components.* | Students explore how the Arduino processes inputs and controls outputs through electronic components. | • Digital Literacy |
| **WA5/6DIGDI1** – *Design algorithms using variables, user input and control structures.* | Students design Arduino programs incorporating variables, delays, loops and conditional logic. | • Numeracy<br>• Digital Literacy |
| **WA5/6DIGDI2** – *Implement algorithms involving variables and iteration.* | Students write Arduino code that controls servo movement based on user interaction. | • Numeracy<br>• Digital Literacy |
| **WA5/6DIGDTID1** – *Break down a design brief.* | Students identify project requirements, functions and constraints before construction begins. | • Critical & Creative Thinking |
| **WA5/6DIGDTID2** – *Select resources considering properties and constraints.* | Students justify their choice of motors, switches and structural components. | • Critical & Creative Thinking |
| **WA5/6DIGDTDE1** – *Develop iterative design solutions.* | Students refine both mechanical design and software through testing and improvement. | • Critical & Creative Thinking |
| **WA5/6DIGDTPI1** – *Implement designed solutions.* | Students integrate electronics, mechanics and programming into a functioning automated device. | • Critical & Creative Thinking<br>• Personal & Social Capability<br>• Digital Literacy |
| **WA6DIGDR1** – *Data represented using binary states.* | Students explore how Arduino digital pins use HIGH/LOW signals to control electronic devices. | • Numeracy<br>• Digital Literacy |

## Years 7–8

**Table 7: Digital Technologies (Years 7–8)**

| Relevant Code | Application to Project | General Capabilities |
|---|---|---|
| **WA7/8DIGDS1** – *Digital systems communicate and transmit data.* | Students investigate how embedded systems process signals between sensors, controllers and actuators. | • Digital Literacy |
| **WA7/8DIGDS2** – *Hardware specifications and performance.* | Students compare different motors, power supplies and controllers to optimise system performance. | • Digital Literacy |
| **WA7/8DIGDI1** – *Analyse user experience.* | Students evaluate how different movement patterns create engaging user interactions. | • Critical & Creative Thinking<br>• Digital Literacy |
| **WA7/8DIGDI2** – *Design algorithms using flowcharts and pseudocode.* | Students produce structured algorithms before writing Arduino code. | • Numeracy<br>• Digital Literacy |
| **WA7DIGDI3 / WA8DIGDI3** – *Debug algorithms.* | Students systematically identify and correct programming errors through testing. | • Digital Literacy (WA8 also Numeracy) |
| **WA8DIGDI4** – *Implement programs in a general-purpose programming language.* | Students develop Arduino C++ programs using functions, loops and conditionals. | • Digital Literacy |
| **WA7/8DIGDTID1–3** – *Investigate design problems and identify constraints.* | Students analyse project requirements, evaluate available components and justify design decisions. | • Literacy (DTID1)<br>• Critical & Creative Thinking |
| **WA7/8DIGDTDE1** – *Design technical solutions.* | Students develop iterative engineering solutions using technical diagrams and documentation. | • Critical & Creative Thinking |

## Years 9–10

**Table 8: Digital Technologies (Years 9–10)**

| Relevant Code | Application to Project | General Capabilities |
|---|---|---|
| **WA9/10DIGDS1** – *Hardware and software manage digital systems.* | Students investigate how embedded hardware and software integrate to produce autonomous behaviour. | • Digital Literacy |
| **WA9/10DIGDI1** – *Define and decompose real-world problems.* | Students identify stakeholder requirements and define functional requirements for the automated device. | • Numeracy<br>• Digital Literacy |
| **WA9/10DIGDI2** – *Design and prototype user experience.* | Students design interaction behaviours that improve usability and engagement. | • Critical & Creative Thinking<br>• Digital Literacy |

| Relevant Code | Application to Project | General Capabilities |
|---|---|---|
| **WA9/10DIGDI3** – *Design modular algorithms using functions.* | Students create reusable Arduino functions to organise complex code efficiently. | • Digital Literacy |
| **WA9/10DIGDI4** – *Validate algorithms through testing.* | Students compare expected outputs with actual behaviour and refine their code through systematic testing. | • Numeracy<br>• Digital Literacy |
| **WA9/10DIGDI5** – *Implement and debug modular programs.* | Students produce robust Arduino programs using modular programming practices and debugging techniques. | • Digital Literacy |
| **WA9/10DIGDTID1–3** – *Investigate stakeholder needs and design constraints.* | Students develop a formal design brief, evaluate technologies and consider engineering constraints. | • Literacy (DTID1)<br>• Critical & Creative Thinking |
| **WA9/10DIGDTDE1** – *Design alternative solutions.* | Students iterate mechanical and software designs to improve performance and reliability. | • Critical & Creative Thinking |

# Science

*The Science content below traces how students investigate energy transfer through the Rebellious Box's circuit and servo mechanism, pose questions and plan fair investigations into its behaviour, and communicate and apply their scientific understanding of electrical and mechanical systems.*

## Years 3–4

**Table 9: Science (Years 3–4)**

| Relevant Code | Application to Project | General Capabilities |
|---|---|---|
| **WA3/4SSUP1** – *Energy can change forms and transfer to other entities.* | Students investigate how electrical energy from the battery is transferred through the circuit and converted into mechanical movement by the servo motor to automatically close the lid. | • Numeracy<br>• Critical & Creative Thinking |
| **WA3/4SSIQ1** – *Pose questions and make predictions.* | Students predict how changing variables such as servo angle, lid weight or program timing will affect the movement of the Rebellious Box. | • Critical & Creative Thinking |
| **WA3/4SSIPL1** – *Plan and conduct investigations.* | Students conduct fair tests by changing one variable at a time while keeping other factors constant to investigate the box's performance. | • Numeracy<br>• Critical & Creative Thinking |
| **WA3/4SSIPR1** – *Organise and represent data.* | Students record observations of servo movement, opening speed and successful operation using tables or simple graphs to identify patterns. | • Numeracy |
| **WA3/4SSIE1** – *Evaluate investigations.* | Students compare the performance of different designs with their predictions and identify improvements for future investigations. | • Critical & Creative Thinking |

| Relevant Code | Application to Project | General Capabilities |
|---|---|---|
| **WA3/4SSICM1** – *Communicate scientific ideas.* | Students explain how electrical energy, circuits and servo motors work using appropriate scientific vocabulary. | • Literacy |
| **WA3/4SSICL1** – *Apply science knowledge.* | Students apply their understanding of energy transfer and circuits to explain why the servo only operates when electrical power is supplied. | • Critical & Creative Thinking |

## Years 5–6

**Table 10: Science (Years 5–6)**

| Relevant Code | Application to Project | General Capabilities |
|---|---|---|
| **WA5/6SSUP1** – *Energy can change forms and transfer to other entities.* | Students investigate how electrical energy is transferred through the circuit and converted into mechanical energy that drives the servo mechanism. | • Numeracy<br>• Critical & Creative Thinking |
| **WA5/6SSIQ1** – *Pose questions and make predictions.* | Students develop investigable questions about how programming values, servo position or mechanical load affect the operation of the box. | • Critical & Creative Thinking |
| **WA5/6SSIPL1** – *Plan and conduct investigations.* | Students plan fair tests by identifying independent, dependent and controlled variables when investigating servo performance. | • Numeracy<br>• Critical & Creative Thinking |
| **WA5/6SSICM1** – *Communicate scientific ideas.* | Students communicate explanations of electrical circuits, energy transfer and servo operation using appropriate scientific terminology. | • Literacy |
| **WA5/6SSICL1** – *Apply science knowledge.* | Students explain how electrical energy is transformed into movement and use this understanding to improve the performance of the Rebellious Box. | • Critical & Creative Thinking |

## Years 7–8

**Table 11: Science (Years 7–8)**

| Relevant Code | Application to Project | General Capabilities |
|---|---|---|
| **WA7/8SSUP1** – *Energy can change forms and transfer to other entities.* | Students investigate how electrical energy is transformed into mechanical motion through the servo motor and analyse factors affecting efficiency. | • Numeracy<br>• Critical & Creative Thinking |
| **WA7SSUP2** – *Simple machines provide mechanical advantage.* | Students investigate how the servo horn functions as a lever, increasing the movement of the lid while examining how lever length affects mechanical performance. | • Numeracy<br>• Critical & Creative Thinking |

| Relevant Code | Application to Project | General Capabilities |
|---|---|---|
| **WA7/8SSIQ1** – *Pose questions and make predictions.* | Students formulate hypotheses about how changing servo speed, lever length or program timing affects system performance. | • Critical & Creative Thinking |
| **WA7/8SSIPL1** – *Plan and conduct investigations.* | Students conduct controlled investigations into mechanical performance by systematically varying one factor at a time. | • Numeracy |
| **WA7/8SSIPR1** – *Process and analyse data.* | Students analyse experimental data to identify relationships between programming values, mechanical design and system performance. | • Numeracy |
| **WA7/8SSIE1** – *Evaluate investigations.* | Students evaluate the validity of their investigation, compare results with predictions and recommend improvements. | • Critical & Creative Thinking |
| **WA7/8SSICM1** – *Communicate scientific ideas.* | Students communicate explanations of energy transformation, force and motion using appropriate scientific language and representations. | • Literacy |
| **WA7/8SSICL1** – *Apply science knowledge.* | Students apply their understanding of energy transfer and simple machines to improve the efficiency and reliability of the Rebellious Box. | • Critical & Creative Thinking |

## Years 9–10

**Table 12: Science (Years 9–10)**

| Relevant Code | Application to Project | General Capabilities |
|---|---|---|
| **WA9/10SSUP1** – *Energy can change forms and transfer to other entities.* | Students analyse the transformation of electrical energy into mechanical work and evaluate factors influencing efficiency within the electromechanical system. | • Numeracy<br>• Critical & Creative Thinking |
| **WA9SSUP2** – *Simple machines provide mechanical advantage.* | Students analyse how the servo horn operates as a lever and investigate how mechanical advantage influences force, movement and system performance. | • Numeracy<br>• Critical & Creative Thinking |
| **WA8/9SSUP3** – *Electrical circuits and energy transformation.* | Students investigate how current flows through the circuit, how the servo acts as a load converting electrical energy into movement, and how electrical safety devices protect circuits and users. | • Numeracy<br>• Critical & Creative Thinking |
| **WA9/10SSIE1** – *Evaluate investigations.* | Students critically evaluate evidence, compare findings with predictions and recommend evidence-based improvements to the system and investigation. | • Critical & Creative Thinking |
| **WA9/10SSICM1** – *Communicate scientific ideas.* | Students communicate explanations of electrical circuits, energy transformations and mechanical systems using precise scientific vocabulary and representations. | • Literacy |