Bucking Bull – WACE Curriculum Mapping

In the Bucking Bull project, students become amusement park engineers, designing, building and coding a model amusement ride that uses a DC motor, gears and a crank-rocker linkage to convert continuous rotational motion into a controlled, oscillating bucking motion. 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, motors and energy transfer, select and justify gear and linkage components, sketch and communicate mechanical design ideas, safely produce their Bucking Bull, and evaluate the finished mechanism 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 a DC motor applies rotational force through gears and linkages to produce the bucking motion. They observe how mechanical components transfer force and motion throughout the system.	• Literacy • Critical & Creative Thinking
WA3/4TDETS1 – *Explore how familiar technologies meet personal and community needs.*	Students explore how motors, gears and mechanical systems are used in everyday machines and amusement rides to create movement.	• Personal & Social Capability • Critical & Creative Thinking
WA3/4TDEDTID1 – *Explore the purpose for designing a solution.*	Students investigate how engineers use gears and mechanisms to convert continuous motor rotation into controlled movement for a themed amusement park ride.	• Critical & Creative Thinking
WA4TDEDTID2 – *Investigate and select resources based on their properties.*	Students select suitable motors, gears, shafts, structural components and fasteners to build a reliable moving mechanism.	• Critical & Creative Thinking
WA3/4TDEDTPI1 – *Design solutions through discussion, modelling and drawings.*	Students produce labelled sketches showing the gear train, linkage mechanism and structural layout before construction.	• Literacy • Critical & Creative Thinking
WA3/4TDEDTPI1 – *Use available technologies and materials to safely create a solution.*	Students safely assemble the mechanical structure, install gears and shafts, wire the motor circuit and test the completed Bucking Bull.	• Personal & Social Capability • Critical & Creative Thinking

Relevant Code	Application to Project	General Capabilities
WA3/4TDEDTPM1 – *Share ideas to develop a solution.*	Students explain how gears and linkages work together, discuss improvements and demonstrate the finished model.	• Literacy • Personal & Social Capability
WA3/4TDEDTE1 – *Use personal preferences to evaluate the solution.*	Students evaluate the smoothness, speed and realism of the bucking motion and identify improvements to the mechanical design.	• Critical & Creative Thinking

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 electrical energy is converted into rotational motion and how gears, shafts and crank-rocker linkages transfer torque to create oscillating movement.	• Literacy • Critical & Creative Thinking
WA5/6TDETS1 – *Examine how technologies meet present and future needs.*	Students investigate how mechanical transmission systems and electric motors are used in robotics, transport and industrial machinery.	• Ethical Understanding • Critical & Creative Thinking
WA5/6TDEDTID1 – *Investigate needs or opportunities for designed solutions.*	Students identify the engineering requirements needed to create a stable, durable and realistic mechanical ride.	• Critical & Creative Thinking
WA5/6TDEDTID2 – *Investigate and select suitable materials, components and technologies.*	Students compare gear sizes, motor characteristics, shafts and structural materials before selecting the most appropriate components.	• Critical & Creative Thinking
WA5/6TDEDTPI1 – *Develop and communicate design ideas.*	Students create annotated engineering drawings showing gear trains, linkage systems and motor placement prior to construction.	• Literacy • Critical & Creative Thinking
WA5/6TDEDTPI1 – *Safely produce designed solutions.*	Students assemble, align and test mechanical systems while applying safe workshop practices and electrical safety procedures.	• Personal & Social Capability
WA5/6TDEDTPM1 – *Plan, manage and communicate production processes.*	Students organise assembly, testing and refinement while documenting design improvements throughout the project.	• Literacy • Personal & Social Capability
WA5/6TDEDTE1 – *Evaluate designed solutions against identified criteria.*	Students evaluate motion quality, gear performance, structural strength and overall mechanical efficiency before refining their design.	• Critical & Creative Thinking

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 influence engineered systems.*	Students investigate how gear ratios, torque transmission and crank-rocker mechanisms convert continuous motor rotation into controlled oscillating motion.	• Literacy • Critical & Creative Thinking
WA7/8TDETS1 – *Investigate how technologies contribute to preferred futures.*	Students explore how efficient electromechanical systems improve automation, manufacturing and sustainable engineering design.	• Ethical Understanding • Critical & Creative Thinking
WA7/8TDEDTID1 – *Investigate and define design problems.*	Students analyse engineering constraints including stability, torque requirements, linkage geometry and durability before developing their solution.	• Critical & Creative Thinking
WA7/8TDEDTID2 – *Investigate and select suitable resources.*	Students evaluate motors, gears, bearings and structural components based on performance, cost and reliability.	• Critical & Creative Thinking
WA7/8TDEDTID3 – *Consider available technologies, resources and components to develop solutions.*	Students justify component selection by comparing mechanical performance, efficiency and manufacturability.	• Critical & Creative Thinking
WA7/8TDEDTPI1 – *Develop and communicate design ideas.*	Students produce engineering drawings, exploded assembly diagrams and mechanical layouts before manufacture.	• Literacy • Critical & Creative Thinking
WA7/8TDEDTPI1 – *Safely produce designed solutions.*	Students manufacture, assemble and test an integrated electromechanical mechanism while applying safe engineering practices.	• Personal & Social Capability
WA7/8TDEDTPM1 – *Plan, manage and document production processes.*	Students manage prototype development, document testing results and refine their mechanism using an iterative engineering process.	• Literacy • Personal & Social Capability
WA7/8TDEDTE1 – *Evaluate designed solutions using design criteria.*	Students evaluate efficiency, reliability, smoothness of motion and mechanical durability against established engineering criteria.	• Critical & Creative Thinking

Years 9–10

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

Relevant Code	Application to Project	General Capabilities
WA9/10TDECEP1 – *Analyse engineering principles including force,*	Students analyse how motor characteristics, torque, gear ratios, shaft design and crank-rocker mechanisms influence the efficiency, reliability and performance of the Bucking Bull.	• Literacy • Critical & Creative Thinking

Relevant Code	Application to Project	General Capabilities
motion, energy and control systems.		
WA9/10TDETS1 – *Evaluate the role of technologies in preferred futures.*	Students evaluate how electromechanical systems contribute to modern robotics, automated manufacturing and sustainable engineering solutions.	• Ethical Understanding • Critical & Creative Thinking
WA9/10TDEDTID1 – *Critically investigate and define complex design problems.*	Students develop an engineering design brief considering functional requirements, user experience, mechanical constraints and manufacturing limitations.	• Critical & Creative Thinking
WA9/10TDEDTID2 – *Investigate and select suitable resources.*	Students evaluate alternative motors, gear trains, bearings and structural materials to optimise performance and durability.	• Critical & Creative Thinking
WA9/10TDEDTID3 – *Evaluate technologies, components and production processes.*	Students justify engineering decisions by comparing mechanical designs, analysing testing data and selecting the most effective manufacturing methods.	• Critical & Creative Thinking
WA9/10TDEDTPI1 – *Develop and communicate engineering solutions.*	Students produce detailed engineering drawings, assembly diagrams and technical documentation to communicate their design prior to manufacture.	• Literacy • Critical & Creative Thinking
WA9/10TDEDTPI1 – *Safely produce and refine designed solutions.*	Students manufacture, assemble, test and refine a complete electromechanical ride using safe workshop practices and iterative engineering techniques.	• Personal & Social Capability
WA9/10TDEDTPM1 – *Manage production processes and evaluate outcomes.*	Students manage project timelines, document design iterations, analyse testing results and evaluate project success against engineering criteria.	• Literacy • Personal & Social Capability
WA9/10TDEDTE1 – *Critically evaluate designed solutions against success criteria.*	Students critically evaluate motion quality, mechanical efficiency, durability, maintainability and user experience, recommending evidence-based improvements for future iterations.	• Critical & Creative Thinking

Digital Technologies

The Digital Technologies content below traces how students investigate the motor and mechanical system as an integrated system, select and justify gear and linkage components, iteratively refine the mechanism, and produce and evaluate their electromechanical solution.

Years 3–4

Table 5: Digital Technologies (Years 3–4)

Relevant Code	Application to Project	General Capabilities
WA3/4DIGDS1 – *Investigate how digital systems use hardware components to perform tasks.*	Students identify how the DC motor works together with the mechanical system to produce controlled mechanical movement.	• Digital Literacy
WA3/4DIGDTID1 – *Investigate and define a design opportunity.*	Students identify how mechanical movement can simulate the motion of a bucking bull.	• Critical & Creative Thinking
WA4DIGDTID2 – *Select suitable resources for a solution.*	Students select gears, shafts, motors and structural components appropriate for the required movement.	• Critical & Creative Thinking
WA3/4DIGDTPI1 – *Safely produce a designed solution.*	Students assemble, wire and test their electromechanical system following safe workshop procedures.	• Critical & Creative Thinking • Personal & Social Capability • Digital Literacy
WA3/4DIGDTPM1 – *Follow plans and communicate ideas.*	Students follow engineering plans, collaborate effectively and evaluate their completed mechanism.	• Literacy • 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 and their interactions.*	Students investigate how the DC motor works in tandem with the mechanical system to create desired rotational motion.	• Digital Literacy
WA5/6DIGDTID1 – *Investigate project requirements and constraints.*	Students analyse how gearing, torque and linkage geometry influence the final movement.	• Critical & Creative Thinking
WA5/6DIGDTID2 – *Select resources based on design requirements.*	Students justify the selection of gears, shafts, bearings and motor components for the mechanism.	• Critical & Creative Thinking
WA5/6DIGDTDE1 – *Develop and refine design solutions.*	Students refine the mechanical assembly to improve stability, efficiency and motion quality.	• Critical & Creative Thinking
WA5/6DIGDTPI1 – *Produce and evaluate a digital solution.*	Students integrate electronics and mechanical systems into a functioning Bucking Bull.	• Critical & Creative Thinking • Personal & Social Capability • Digital Literacy

Relevant Code	Application to Project	General Capabilities
WA5/6DIGDTPM1 – *Manage project resources and timelines.*	Students organise construction, testing and iterative improvements while documenting engineering decisions.	• Literacy • Personal & Social Capability

Years 7–8

Table 7: Digital Technologies (Years 7–8)

Relevant Code	Application to Project	General Capabilities
WA7/8DIGDS2 – *Evaluate hardware for intended purposes.*	Students compare motor types, gear ratios and power systems to optimise movement performance.	• Digital Literacy
WA7/8DIGDI1 – *Analyse user experience.*	Students evaluate how different movement speeds, oscillation angles and motion profiles affect the realism of the Bucking Bull.	• Critical & Creative Thinking • Digital Literacy
WA7/8DIGDTID1–3 – *Investigate design opportunities and evaluate resources.*	Students investigate engineering constraints, compare mechanical solutions and justify component selection.	• Literacy (DTID1) • Critical & Creative Thinking
WA7/8DIGDTDE1 – *Design and refine digital solutions.*	Students iteratively improve gear trains, linkage geometry and programming to optimise performance.	• Critical & Creative Thinking
WA7/8DIGDTPI1 – *Produce and evaluate digital solutions.*	Students integrate electronics and mechanical assemblies into a reliable automated machine.	• Critical & Creative Thinking • Personal & Social Capability • Digital Literacy
WA7/8DIGDTPM1 – *Apply project management processes.*	Students plan construction stages, evaluate prototypes and manage collaborative engineering tasks.	• Personal & Social Capability

Years 9–10

Table 8: Digital Technologies (Years 9–10)

Relevant Code	Application to Project	General Capabilities
WA9/10DIGDS1 – *Investigate integrated hardware and software systems.*	Students analyse how motors and mechanical systems interact to produce controlled mechanical motion.	• Digital Literacy
WA9/10DIGDI1 – *Define and decompose engineering problems.*	Students identify engineering requirements, constraints and performance criteria for an automated amusement ride.	• Numeracy • Digital Literacy

Relevant Code	Application to Project	General Capabilities
WA9/10DIGDI2 – *Design user experiences.*	Students evaluate how mechanical motion, timing and ride behaviour influence user engagement and realism.	• Critical & Creative Thinking • Digital Literacy
WA9/10DIGDTID1–3 – *Investigate stakeholder needs and engineering constraints.*	Students develop a formal engineering brief, evaluate alternative mechanisms and justify design decisions using performance criteria.	• Literacy (DTID1) • Critical & Creative Thinking
WA9DIGDR1 / WA9DIGDR2 – *Represent and manipulate digital data.*	Students investigate how PWM values, digital outputs and embedded data structures control motor behaviour and system performance.	• Numeracy • Digital Literacy
WA9/10DIGDTPM1 – *Manage digital projects.*	Students apply engineering project management processes, document design iterations, evaluate outcomes and manage project risks throughout development.	• Literacy • Personal & Social Capability • Critical & Creative Thinking (Years 9–10 also include Numeracy and Ethical Understanding)

Science

The Science content below traces how students investigate energy transfer through the Bucking Bull's motor, gears and linkages, the mechanical advantage provided by its simple machines, and pose questions, plan investigations, and communicate and apply their scientific understanding of forces, energy and electricity.

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 energy by the DC motor to create the bucking motion.	• Numeracy • Critical & Creative Thinking
WA3/4SSIQ1 – *Pose questions and make predictions.*	Students predict how changing variables such as gear size, linkage length or motor speed will affect the movement of the Bucking Bull.	• Critical & Creative Thinking
WA3/4SSIPL1 – *Plan and conduct investigations.*	Students conduct fair tests by changing one mechanical variable at a time while observing the resulting motion of the Bucking Bull.	• Numeracy • Critical & Creative Thinking
WA3/4SSIPR1 – *Organise and represent data.*	Students record observations of movement, speed and stability using tables or simple graphs to identify patterns in the mechanical system.	• Numeracy

Relevant Code	Application to Project	General Capabilities
WA3/4SSIE1 – *Evaluate investigations.*	Students compare the performance of different gear and linkage configurations with their predictions and identify possible improvements.	• Critical & Creative Thinking
WA3/4SSICM1 – *Communicate scientific ideas.*	Students explain how electrical energy, force and movement work together in the Bucking Bull using appropriate scientific vocabulary.	• Literacy
WA3/4SSICL1 – *Apply science knowledge.*	Students apply their understanding of energy transfer and forces to explain how the DC motor produces the Bucking Bull's motion.	• 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 converted into rotational motion by the motor and transferred through gears and linkages to create oscillating movement.	• Numeracy • Critical & Creative Thinking
WA5/6SSIQ1 – *Pose questions and make predictions.*	Students develop investigable questions about how gear ratios, linkage length or motor speed influence the movement and stability of the Bucking Bull.	• Critical & Creative Thinking
WA5/6SSIPL1 – *Plan and conduct investigations.*	Students design fair investigations by identifying independent, dependent and controlled variables while testing mechanical performance.	• Numeracy • Critical & Creative Thinking
WA5/6SSIPR1 – *Organise and represent data.*	Students collect and display data such as bucking speed, movement angle and stability using tables and graphs.	• Numeracy
WA5/6SSIE1 – *Evaluate investigations.*	Students compare findings with predictions, evaluate the reliability of their investigation and recommend improvements to the mechanical design.	• Critical & Creative Thinking
WA5/6SSICM1 – *Communicate scientific ideas.*	Students communicate explanations of energy transfer, forces and mechanical systems using scientific terminology.	• Literacy
WA5/6SSICL1 – *Apply science knowledge.*	Students explain how motors, gears and linkages work together to convert electrical energy into controlled movement.	• 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 energy and transferred through gears, shafts and linkages to produce the Bucking Bull's motion.	• Numeracy • Critical & Creative Thinking
WA7SSUP2 – *Simple machines provide mechanical advantage.*	Students investigate how gears, levers (linkages), and wheels and axles provide mechanical advantage, transfer force and alter motion within the Bucking Bull mechanism.	• Numeracy • Critical & Creative Thinking
WA7/8SSIQ1 – *Pose questions and make predictions.*	Students formulate hypotheses about how changing gear ratios, linkage geometry or motor speed affects torque, movement and stability.	• Critical & Creative Thinking
WA7/8SSIPL1 – *Plan and conduct investigations.*	Students conduct controlled investigations by systematically varying one mechanical component while measuring the effect on movement.	• Numeracy
WA7/8SSIPR1 – *Process and analyse data.*	Students analyse experimental data to identify relationships between gear ratios, linkage design and the resulting bucking motion.	• Numeracy
WA7/8SSIE1 – *Evaluate investigations.*	Students evaluate the validity of their investigation, compare findings with predictions and recommend evidence-based improvements to the mechanism.	• Critical & Creative Thinking
WA7/8SSICM1 – *Communicate scientific ideas.*	Students communicate explanations of energy transformation, force, motion and mechanical advantage using scientific language and diagrams.	• Literacy
WA7/8SSICL1 – *Apply science knowledge.*	Students apply their understanding of energy transfer and simple machines to optimise the Bucking Bull's movement and efficiency.	• 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 how electrical energy is transformed into mechanical work by the DC motor and transferred through gears and linkages, evaluating factors that influence efficiency and performance.	• Numeracy • Critical & Creative Thinking
WA9SSUP2 – *Simple machines provide mechanical advantage.*	Students analyse how gears, levers (linkages), and wheel-and-axle systems provide mechanical advantage, modify force and motion, and influence torque, speed and efficiency.	• Numeracy • Critical & Creative Thinking
WA8/9SSUP3 – *The flow of electricity through a circuit is affected by the*	Students investigate how current flows through the Bucking Bull's electrical circuit, how the DC motor acts as an electrical load converting	• Numeracy • Critical & Creative Thinking

Relevant Code	Application to Project	General Capabilities
type of circuit; loads transform electrical energy; safety devices protect electrical systems.	electrical energy into mechanical motion, and why correct wiring and circuit protection are important for safe operation.	
WA9/10SSIQ1 – *Pose questions and make predictions.*	Students formulate hypotheses about how gear ratios, linkage design, motor speed and structural changes influence movement, efficiency and reliability.	• Critical & Creative Thinking
WA9/10SSIPL1 – *Plan and conduct investigations.*	Students design controlled investigations by identifying variables, collecting accurate measurements and evaluating the mechanical performance of the Bucking Bull under different conditions.	• Numeracy
WA9/10SSIPR1 – *Process, model and analyse data.*	Students analyse experimental data using tables and graphs to identify trends between gear ratios, linkage geometry, motor performance and overall movement.	• Numeracy
WA9/10SSIE1 – *Evaluate investigations.*	Students critically evaluate evidence, compare findings with predictions and recommend evidence-based improvements to both the investigation and the mechanical system.	• Critical & Creative Thinking
WA9/10SSICM1 – *Communicate scientific ideas.*	Students communicate explanations of electrical circuits, energy transformations, force, motion and mechanical advantage using precise scientific vocabulary and appropriate representations.	• Literacy
WA9/10SSICL1 – *Apply science knowledge.*	Students apply their understanding of physics principles to optimise the Bucking Bull's performance and explain how its integrated electromechanical system operates.	• Critical & Creative Thinking