

STEM Stage 4 | Science, Technology Mandatory, Mathematics | Mousetrap Cars

Summary

In this unit of work students produce a mousetrap car. Through a range of design, experimentation and testing procedures students are set the challenge of creating a mousetrap car with a balance of velocity, durability and aesthetic features. Throughout the design, development and practical creation of the project, student teams expand their knowledge of Science, Technology, Engineering and Mathematics as they collaboratively improve and apply their content knowledge to practical problem-solving situations. To complement the hands-on practical engineering, mathematics and science applied in this unit, teams record their evidence of scientific testing, mathematical problem-solving and design successes and failures through the use of BYOD technology, culminating in the presentation of a portfolio using photos and/or video files highlighting their work throughout the unit.

Teacher background information

This unit of work builds on knowledge and skills covered in Stage 4 Science, Mathematics and Technology Mandatory. Students should have experience using a process of design, tools, equipment, concepts and knowledge learnt in Science, Mathematics and technology which will be reinforced and applied in the practical project. Students will have the opportunity to work collaboratively to design, test, manage and document their processes.

Teachers are encouraged to design and produce their own mousetrap cars to use as examples and in demonstrations to students throughout the project.

Final submissions and assessment opportunities could include the finished mousetrap car, performance in the final challenge, a documentation folio and a presentation video.

An example and some project ideas can be found at <https://www.lumen-stem.com/mousetrap-cars.html>

The content in the unit is fluid and content/activities should be addressed as appropriate throughout the project. As an extension activity students could create a timing gate using an Arduino board and laser diode and detector.

Key inquiry questions

- How can we create transport solutions that contribute to sustainable solutions?
- What factors can affect speed? What happens when objects collide?
- How can STEM assist in design solutions that create ethical and sustainable solutions to global problems?

Outcomes

Science K–10 (including Science and Technology K–6)

- › SC4-4WS identifies questions and problems that can be tested or researched and makes predictions based on scientific knowledge
- › SC4-5WS collaboratively and individually produces a plan to investigate questions and problems
- › SC4-10PW describes the action of unbalanced forces in everyday situations

Technology Mandatory

- › 4.1.1 applies design processes that respond to needs and opportunities in each design project
- › 4.2.1 generates and communicates creative design ideas and solutions
- › 4.2.2 selects, analyses, presents and applies research and experimentation from a variety of sources

Duration

6 weeks
100 minutes a week

Resources overview

- <https://www.lumen-stem.com/mousetrap-cars.html>
- starter packs for students
- Hot glue, hot glue guns, PVA and other joining consumables
- Axles, wheels, motors, propellers

Vocabulary

aesthetics, alignment, axle, circumference, collide, compression, data, design, engineer, friction, modelling, orthogonal, radius, rotation, safety, skew, solder, solution, speed, symmetry, tension, vehicle, velocity

- › 4.3.1 applies a broad range of contemporary and appropriate tools, materials and techniques with competence in the development of design projects
- › 4.3.2 demonstrates responsible and safe use of a range of tools, materials and techniques in each design project
- › 4.5.2 produces quality solutions that respond to identified needs and opportunities in each design project
- › 4.6.1 applies appropriate evaluation techniques throughout each design project

Mathematics K–10

- › MA4-2WM a student applies appropriate mathematical techniques to solve problems – problem solving
- › MA4-6NA solves financial problems involving purchasing goods
- › MA4-7NA operates with ratios and rates, and explores their graphical representation
- › MA4-12MG calculates the perimeters of plane shapes and the circumferences of circles
- › MA4-13MG uses formulas to calculate the areas of quadrilaterals and circles, and converts between units of area
- › MA4-14MG uses formulas to calculate the volumes of prisms and cylinders, and converts between units of volume

Syllabus Content

Technology Mandatory

4.1.1 applies design processes that respond to needs and opportunities in each design project

Students learn about:

- design processes including
 - analysing needs, problems and opportunities
 - establishing criteria for success
 - generating creative ideas

4.2.2 selects, analyses, presents and applies research and experimentation from a variety of sources

Students learn about:

- experimentation and testing of design ideas
- research methods
- searching techniques including use of the Internet

Students learn to:

- use effective research methods to identify needs and opportunities and locate information relevant to the development of each design project
- use the internet when researching

4.3.2 Demonstrates responsible and safe use of a range of tools, materials and techniques in each design project

Students learn about:

- risk management strategies
- responsible behaviour in working environments
- Workplace Health and Safety practices
- materials, tools and techniques in each design project safely and responsibly

Teaching, learning and assessment

Week 1: Design brief

Summary

Students are presented with the design brief and form their STEM teams. Within their teams, roles are established, then the provided materials and tools are outlined to stimulate the creative thought processes within the teams. Relevant Workplace Health and Safety (WHS) issues and procedures are addressed. Students recognise that transport is a significant contributor to carbon emissions and alternative power sources for transport need to be investigated.

Resources

- School/faculty's standard WHS system for demonstration and training of relevant tools, equipment and specialist quality learning environments
- Sample mousetrap car
- Sustainability in energy use: [Can 100% Renewable Energy Power the World?](#)

Design brief

- Students are presented with the design brief:
 - 'Design, produce and evaluate a mousetrap car that incorporates simple machines. It will need to move an egg to give to a neighbour, safely.'
- Students are provided with an outline of the range of tools, techniques and equipment to be used in the production of their mousetrap cars, including simple motors, wheels and axles. However the experimentation, selection and use of alternative materials is greatly encouraged.
- Teacher shows an example mousetrap car, explains the basic functionality and allows time for students to ask questions.
- Students jointly develop a criteria for success, for example (see rubric and essential/desirable features):
 - 'Mousetrap cars must be able to deliver an egg safely, and meet social distancing guidelines. All appropriate work, health and safety practices must be followed'.
 - .'

Student diversity

Whole class explanation – WHS

- Specific demonstration of relevant machinery and processes will occur throughout the unit.
- Students will complete mandatory safety tests relevant to this unit of work, including the use of the hot glue gun, woodworking and metalworking hand tools.

STEM teams

- Students form teams of three-four to produce their mousetrap cars, with each student accepting the lead role for one of the following positions:
 - *lead designer* – graphical design work and aesthetic finishes
 - *lead engineer* – the practical production
 - *lead scientist* – the research, experimentation and testing
 - *data/media manager* – the collation and presentation of ALL of the team's work and data including the creation of the team's presentation video.
- While all students are encouraged to make holistic and collaborative contributions to the unit, one student needs to accept responsibility for each of the key roles.
- Students discuss the design brief and any initial ideas, documenting them in a mind map.

Initial research and design

- Students are encouraged to explore primary and secondary research methods to collect data and inspiration for their mousetrap car design ideas.
- Teams collaborate to identify the purpose of their research and investigation.
- Based on the initial research and investigation, teams develop rough sketches with initial dimensions included to identify perimeter, wheel circumference and the various geometries of the components that will make up their mousetrap car designs.

Assessment

- Adherence to/completion of mandatory WHS demonstrations and training requirements.
- Verbal feedback provided based on student research and thumbnail sketches.
- [Can 100% renewable energy power the world?](#) Google form

Week 2: Observing, designing and testing

Summary

Students watch the demonstration of a variety of mousetrap cars and discuss their observations, with reference to the established criteria. Students develop skills in creating conceptual designs and engineering drawings, producing a concept sketch, orthogonal drawing for their designs. Students conduct tests on a variety of materials to observe their properties, and provide data to guide the selection of suitable materials for use in their mousetrap cars.

Resources

- [A Guide to the Energy of the Earth](#) (TED-Ed)
- F = ma investigation:
 - F = ma simulation – [Forces and Motion: Basics - Force | Motion | Friction](#)
 - F = ma video - *Newton's Second Law of Motion (F=ma)* by Doodle Science (1 min 14 s)

Science

Working Scientifically

WS4 Students question and predict

WS5.1 Students identify data to be collected in an investigation

WS5.2 Students plan first-hand investigations

WS5.3 Students choose equipment or resources for an investigation

Physical World

PW1 Change to object's motion is caused by unbalanced forces acting on the object (ACSSU117)

Students:

- Identify changes that take place when particular forces are acting

Support

- Students may use (and modify) the teacher template provided.

Extension

- Students may choose to CAD model an entire STEM Racer OR design a specific component to be 3D printed or machined using CNC technology.
- Show and discuss video explaining F = ma and/or

- Predict the effect of unbalanced forces acting in everyday situations

PW2 The action of forces that act at a distance may be observed and related to everyday situations

Students:

- Identify that the Earth's gravity pulls objects towards the centre of the Earth (ACSSU118)
- Describe everyday situations where gravity acts as an unbalanced force
- Distinguish between the terms 'mass' and 'weight'

Technology Mandatory

4.2.1 generates and communicates creative design ideas and solutions

Students learn about:

- methods to generate creative design ideas including
 - mind mapping
 - brainstorming
 - sketching and drawing
 - modelling
 - experimenting and testing

Students learn to:

- sketch, draw and model to aid design development

4.2.2 selects, analyses, presents and applies research and experimentation from a variety of sources

Students learn about:

- experimentation and testing of design ideas

Students learn to:

- apply the results of experimentation to designing and making when developing each design project

4.3.1 applies a broad range of contemporary and appropriate tools, materials and techniques with competence in the development of design projects

Graphics Technologies

Students learn about:

- the range, suitability and use of materials, resources
- the features of common graphic data types
- specific tools relating to graphics technologies
- the function, selection and correct use of a range contemporary tools used for
 - simple drafting including multi-view drawing
 - extension: CAD/paint/draw software
 - industrial production methods

- Video explaining 'friction'
- Existing product designs, including conceptual renderings
- Project task sheets
- A range of material samples (starter packs) for testing

Demonstration and discussion

- Using existing mousetrap car designs, practical demonstrations are conducted to test the velocity and durability of existing successful designs.
- Teacher poses the following questions to students for consideration and discussion:
 - Why doesn't the mousetrap car start when the lever is released?
 - Why are some mousetrap cars faster than others?
 - What causes some mousetrap cars to divert off the track?
 - Why do some mousetrap cars 'drift'?
 - What do you predict will happen when the two mousetrap cars collide?
- Students complete three PINE (Positive, Interesting, Negative, Evaluation) analyses on these existing designs, including the:
 - Velocity – This can be estimated in metres per second by calculating the circumference of the racetrack (using the radius and π) and timing how long the Racer takes to complete a lap.
 - Durability – What features improve durability?
 - Aesthetics – What features are used to improve the look and style of the mousetrap cars? Are these effective? Do they negatively affect the functionality?
- Teacher leads discussion to question the efficiency of the wheel and axle systems, briefly exploring the concepts of friction, coefficient of friction and strategies for reducing friction in working components. Students can watch a [video explaining friction](#).

F=ma investigation

- Discuss the law of conservation of energy. Complete the Google form "[A Guide to the Energy of the Earth](#)".
- Discuss the formula $F = ma$ to determine prior knowledge.
- Students conduct a simple experiment to observe the relationship between force, mass and acceleration.
- Discuss the results of the experiment, including how it relates to the mousetrap car designs.

Designing

- Teams use their research and testing to help shape their initial design.
- Teacher demonstrates the production of a high-quality rendered design concept that includes a drawing, texture/colour, black outline, shadow, annotations, dimensioning, background, border, product name and designer/team name.
- Each team member creates one conceptual design sketch, so three or four different design concepts are developed for consideration.
- Students collaborate to select their preferred design.
- The final conceptual design is improved based on feedback from all team members.
- Teacher introduces the basics of orthogonal projection and drawing standards.
- The team produces one quality orthogonal drawing of their intended design including a front view, top view, and right-hand view.


investigate using an online simulation.

- Discuss: Why do some mousetrap cars become 'airborne'? What forces are involved?

Mathematics

Ratio and rates

Solve a range of problems involving ratios and rates, with and without the use of digital technologies (ACMNA188)


- convert given information into a simplified rate, eg 150 kilometres travelled in 2 hours = 75 km/h
- solve a variety of real-life problems involving rates, including problems involving rate of travel (speed) 

Length

Students:

Investigate the relationship between features of circles, such as the circumference, radius and diameter; use formulas to solve problems involving circumference (ACMMG197)

- develop and use the formulas to find the circumferences of circles in terms of the diameter d or radius r :
Circumference of circle = πd

Circumference of circle = $2\pi r$ 

Volume

Develop the formulas for the volumes of rectangular and triangular prisms and of prisms in general; use formulas to solve problems involving volume (ACMMG198)

- develop the formula for the volume of prisms by considering the number and volume of 'layers' of identical shape:


Volume of prism = base area \times height leading to $V = Ah$  

- ▶ recognise the area of the 'base' of a prism as being identical to the area of its uniform cross-section (Communicating, Reasoning)


- find the volumes of prisms, given their perpendicular heights and the areas of their uniform cross-sections
- find the volumes of prisms with uniform cross-sections that are rectangular or triangular
- solve a variety of practical problems involving the volumes and capacities of right prisms

Calculate the volumes of cylinders and solve related problems (ACMMG217)

- develop and use the formula to find the volumes of cylinders:
Volume of cylinder = $\pi r^2 h$ where r is the length of the radius of the

base and h is the perpendicular height 

- ▶ recognise and explain the similarities between the volume formulas for cylinders and prisms


(Communicating) 

Materials investigation

- Teacher leads the investigation of a range of materials (in different shapes) and their basic properties (e.g. compressive strength, tension, mass, bending, torsion, durability). For example:
 - Comparison between timber, metal and polymers
 - Comparison between a sheet/length of timber and a dowel.
- Students calculate the volume to mass ratio to determine the material's density.
- Students identify THREE explicit tests they would like to conduct. For example:
 - Timber in cylindrical form will withstand greater bending force than a length of the same timber
 - The greater the density the more durable the material.
- Students question and make predictions about how each material will react when forces are applied.
- Teacher discusses what is meant by a 'fair test', and assists students in their identification of dependent and independent variables, and what data they will be recording.
- Students record their qualitative and quantitative observations as the forces are applied.
- Students write up a brief report (experiment title, aim, method, results, application of conclusions), summarising their findings from the investigations.
- Students could conduct further research into the tested materials, for example comparing the molecular structure of two types of material, eg cardboard and timber.

Assessment

- Informal assessment of student/team designs with feedback provided for possible improvements.
- Tests, drawings, equations and analysis documents produced.

- solve a variety of practical problems involving the volumes and capacities of right prisms and cylinders, eg find the capacity of a cylindrical drink can or a water tank 

Technology Mandatory

4.2.1 generates and communicates creative design ideas and solutions

Students learn about:

- use of design folio to record and reflect on design ideas and decisions
- communication methods including
 - drawings, sketches and models
 - written reports

4.3.1 applies a broad range of contemporary and appropriate tools, materials and techniques with competence in the development of design projects

Mixed Material Technologies:


Students learn about:

- characteristics and properties of a wide range of materials such as:
 - metals
 - polymers
 - textiles
 - timber
- the use of materials in traditional and non-traditional ways
- specific tools related to materials appropriate to a design project
- the function and safe use of a range of contemporary tools used for:
 - measuring
 - marking out
 - cutting
 - construction
- traditional and non-traditional techniques used for:
 - cutting
 - shaping a variety of materials

Mathematics

Financial Mathematics

Investigate and calculate 'best buys', with and without the use of digital technologies (ACMNA174)

- calculate 'best buys' by comparing price per unit, or quantity per monetary unit, eg 500 grams for \$4.50 compared with 300 grams for \$2.75 

Week 3: Project production and documentation

Summary

Students begin the production of their mousetrap car with the construction of the chassis. Students use digital technology to record the production process.

Resources

- Students are encouraged to bring in their own resources and materials, based on their conclusions from the materials testing to make the wheels and axles.
- The teacher may provide students with radiata pine, or similar materials.
- Hot glue, hot glue guns, PVA and other joining consumables

Safety







- Class discussion around appropriate and acceptable use of recording devices to be revised.
- Teacher to outline and demonstrate WHS requirements relating to the tools and materials in the construction of the chassis.

Documenting the production

- Students are encouraged to use digital technology to record their team's progress throughout design, testing and manufacture:
 - photographs of their work
 - scan practical design
 - video of the racer being tested
 - summary of testing activities
 - final budget.
- Teacher to explain as necessary: image file creation, saving, storing and transfer.

Chassis construction

- Multiple methods for creating the chassis of a mousetrap car are demonstrated to students, including:
 - the 'traditional' framed construction
 - using a 'block' to shape and form
 - recycling/upcycling existing materials/objects.
- A range of MMC (Measure, Mark and Cut) methods are demonstrated, based on the range of materials and tools used.
- Students explore costing of materials for their chassis, including 'best buy' and other considerations (eg amount required and waste):
 - Where can we source materials?
 - How much does the material cost per length (m), area (m²) or volume (m³)? What appears to be the best buy?

- ▶ investigate 'unit pricing' used by retailers and use this to determine the best buy (Problem Solving) 
- ▶ recognise that in practical situations there are considerations other than just the 'best buy', eg the amount required, waste due to spoilage (Reasoning) 

- ▶ use price comparison websites to make informed decisions related to purchases under given conditions (Problem Solving) 

Science

Physical World

PW1 Change in object's motion is caused by unbalanced forces acting on the object (ACSSU117)

Students:

- Identify changes that take place when particular forces are acting
- Predict the effect of unbalanced forces acting in everyday situations
- Describe some examples of technological developments that have contributed to finding solutions to reduce the impact of forces in everyday life, for example, car safety equipment and footwear design

PW2 The action of forces that act at a distance may be observed and related to everyday situations.

Students:

- Identify that the Earth's gravity pulls objects towards the centre of the Earth (ACSSU118)
- Describe everyday situations where gravity acts as an unbalanced force
- Distinguish between the terms 'mass' and 'weight'

Science

Physical World

- What is the minimum length/area of material that we need?
- How much material will be wasted? How can we minimise this?
- Should we buy extra material in case a part fails or we decide to make modifications?
- Can we team up with another group who has similar material requirements to reduce the cost?
- Teams document questions and problems as they work through the early stages of the mousetrap car's production. Teams record their ongoing evaluation, predictions, observations and testing for inclusion in their presentation assignment.

Week 4: Forces in action

Summary

Students learn how to use simple machines in their mousetrap car and explore the other types of forces experienced in the mousetrap car.

Resources

- Simple machines videos: <https://www.lumen-stem.com/mousetrap-cars.html>

Centre of mass

- Teacher explains (and demonstrates) simple machines.
- Students explore simple machines in the classroom.
- Teacher leads discussion on the importance of understanding simple machines in producing a successful mousetrap car (as well as many other functional products in society).
- Using existing designs and their developing mousetrap car, students use a straight edge to balance the mousetrap car on an axis to estimate the position of the centre of mass. These experiments help students to determine the most appropriate position for their mousetrap and where the tethered string will be attached.

Consideration of other forces

- Class brainstorms examples of technological developments that have contributed to finding solutions to reduce the impact of forces in everyday life, e.g. bike suspension, lubricants.
- Teams discuss how these technological developments may be used in the design of the mousetrap car.
- Teacher further explains the forces of tension and compression.
- Teacher introduces the forces when racing a mousetrap car, including:
 - tension in the string anchoring the mousetrap to the axle which is generated by the potential energy of the spring
 - the various forces on components in the mousetrap car upon collision with another mousetrap car.

Week 5: Putting the mousetrap car together

Summary

Extension

- Students draw free body diagrams to show the forces acting on their mousetrap car.

Extension

- Students research and present a case study comparing two

PW1 Change to object's motion is caused by unbalanced forces acting on the object (ACSSU117)

Students:

- Predict the effect of unbalanced forces acting in everyday situations
- Describe some examples of technological developments that have contributed to finding solutions to reduce the impact of forces in everyday life, for example, car safety equipment and footwear design

Technology Mandatory

4.3.1 applies a broad range of contemporary and appropriate tools, materials and techniques with competence in the development of design projects

Mixed Material Technologies:

Students learn about:

- The function and safe use of a range of contemporary tools used for:
 - measuring
 - marking out
 - cutting
 - construction
- Traditional and non-traditional techniques used for:
 - cutting
 - shaping a variety of materials
 - joining different material

Students learn to:


- select and use a wide range of materials for the identified needs and opportunities of a design project
- select and safely use tools and equipment for a design project
- experiment with traditional and non-traditional techniques

Mathematics

Area

Establish the formulas for areas of rectangles, triangles and parallelograms and use these in problem solving (ACMMG159)

- develop and use the formulas to find the areas of rectangles and squares:
Area of rectangle= lb where l is the length and b is the breadth (or width) of the rectangle

Area of square= s^2 where s is the side length of the square 



Students learn about the importance of precise geometry and high design tolerance in their mousetrap car including the alignment of axles and vehicle symmetry. Students explore different methods and materials for joining and putting together the chassis and body of their mousetrap car. Students identify areas where friction is occurring within their mousetrap car and make adjustments to reduce this force.

Resources

- Design tolerance definition – <http://dictionary.sensagent.com/ENGINEERING%20TOLERANCE/en-en/>
- Axles, wheels, motors, propellers – *Axle and wheels may be provided in any number of formats. Bamboo skewers are ideal for 3mm axles, wheels may be designed, cut and 'mass produced' in the school workshops using a selected material OR commercial kits from various sources.*
- Joining materials and tools, eg hot glue gun
- Friction quiz – http://www.physics4kids.com/extras/quiz_motion_friction/

Safety

- Throughout the production of student projects the teacher demonstrate the SOP (Safe Operating Procedure) for each process, including the use of a range of wood working and metal working hand tools, model making tools, light machinery, power tools and general workshop safety.
- Teacher records these demonstrations using school/faculty designated policy.

Geometry in design

- Teacher leads brainstorm of where mathematics, in particular measurement and geometry, is needed in design and engineering. For example the mass of a timber chassis can be estimated by:
 1. identifying the simple composite figures in the scale drawing and calculating the total area of timber to be used
 2. using the area to calculate the volume
 3. using the density to calculate the mass.
- Teacher provides case studies/examples of issues with tolerance in a range of designed products in society. Students discuss the impact of the tolerance issues on the quality of the products.
- Students discuss:
 - the importance of accurate measurement and geometry in the design and production of a quality product and identify key features of their mousetrap cars where accurate geometry is very important
 - how calculating features prior to construction can allow for improvements, for example calculating the mass of the chassis and identifying where the mass can be reduced.
- Teacher demonstrates the most appropriate measurement techniques and tools to ensure accurate dimensions of components, marking out of holes for axles and the creation of desired angles for functional design.
- Students continue with the practical application of mathematics in the production of their mousetrap cars.




Joining methods

- Teacher demonstrates a range of joining methods to students, including adhesives and fixing components, eg screws, PVA glue, hot glue, gussets, press fits.
- Teacher leads class discussion around the positives and negatives for using a range of adhesives and fixing components.
- Students select a suitable joining method to form the chassis and body of their mousetrap cars.

similar products, comparing and evaluating the similarities and differences between a product with lower and higher tolerances in design.

- ▶ develop, with or without the use of digital technologies, and use the formulas to find the areas of parallelograms and triangles, including triangles for which the perpendicular height needs to be shown outside the shape:

Area of triangle = $1/2bh$ where b is the length of the base

and h is the perpendicular height   

- find the areas of simple composite figures that may be dissected into rectangles, squares, parallelograms and triangles

Volume

Develop the formulas for the volumes of rectangular and triangular prisms and of prisms in general; use formulas to solve problems involving volume (ACMMG198)

- find the volumes of prisms, given their perpendicular heights and the areas of their uniform cross-sections

Science

Physical World

PW3 Energy appears in different forms including movement (kinetic energy), heat and potential energy, and causes changes within systems (ACSSU155)

Students:

- Relate electricity with energy transfer in a simple circuit
- Construct and draw circuits containing a number of components to show a transfer of electricity

Technology Mandatory

4.2.1 Generates and communicates creative design ideas and solutions

Students learn about:

- methods to generate creative design ideas including:
 - brainstorming
 - sketching and drawing
- modelling
- experimenting and testing
- use of design folio to record and reflect on design ideas and decisions
- communication methods including:
 - drawings, sketches and models
 - written reports
 - oral presentations
 - digital presentations

Reducing friction

- Using existing designs as examples, teacher leads discussion on the consequences of axle holes created out of alignment.
- Students discuss in their teams: 'What other limiting factors will affect the performance of the wheel system in your design?'
- Teacher leads students to the concepts of friction between the axles and the chassis, wheels and the surface, and the force created from mass above the wheel axis. This discussion leads on to the importance of symmetry and the importance for equal dispersion of mass on the left and right-hand sides of the mousetrap cars.
- Students continue with practical production, aligning axles and fitting the wheel system to their design.

Assessment

- Optional: Students complete the online friction quiz (see Resources - Friction quiz)
- Ongoing assessment of the team's practical application of mathematical principles in practical production ensuring high tolerance levels and quality.
- As final production nears completion, teacher feedback is provided verbally to assist students in producing the highest quality and most innovative design project possible.

Week 6: Let's race!

Summary

Students participate in the final knockout racing challenge. After the winner is decided each team evaluates their performance, process and teamwork. Students edit and collate their documentation, images and video for presentation in a collaboratively made video.

Resources

- Measuring tools, eg stopwatch, tape measure
- Camera/video camera
- BYOD technology and associated application(s) and/or access to a school computing laboratory with appropriate video/image editing software.

Race day

- Students use the project criteria to identify designs they think will perform the best.
- Mousetrap Car Challenge team names are placed into a hat and the first two competitors are selected randomly. Students calculate the probability of their mousetrap car being selected in the first heat.
- Students discuss whether they think the mousetrap car has an 'equally' likely chance of winning. Students vote on which mousetrap car they think will win, based on their assessment of the design. The teacher tallies the votes, and students calculate the votes as percentages.
- Mousetrap car race in a 'best of three' format to determine who advances to the next round.
- The next two names are drawn out of the hat to compete and the process is repeated.

Project presentation

- Teacher outlines the criteria for the video presentation.
- Students collate images and videos using computers/tablets and appropriate software.
- Students add text and audio to help tell the 'story' of their process.

Extension

- Students represent the random selection process using a two-step probability tree.
- Teachers/students may produce a customised modular racetrack for the unit of work.
- Students create a budget for the complete Racer for their final presentation.

- communication methods suitable for specific audiences including:
 - users and clients
 - peers
 - using ICTs to plan, develop and document design projects
- 4.3.1 applies a broad range of contemporary and appropriate tools, materials and techniques with competence in the development of design projects

Media

Students learn about:

- software including desktop publishing, presentation, video editing, draw and paint, word processing, web design
- organising information for an appropriate audience

4.6.1 applies appropriate evaluation techniques throughout each design project

Students learn about:

- final evaluation considering:
- design process used
- design solutions
- reflection on learning

Mathematics

Probability 1

Construct sample spaces for single-step experiments with equally likely outcomes (ACMSP167)

- Students seek feedback from peers to improve their video.
- Students present their video to the class.
- Students digitally share their video with the teacher and class.

Assessment

- Mousetrap car performance in the race
- Projects are marked using an appropriate marking scheme.

Assessment overview

- Assessment for this unit of work should follow the school's policies and procedures.
- Teachers should conduct both informal and formal assessment of the students on their engagement, participation and final project submission.
- Refer to the unit overview document for assessment for learning ideas for each outcome.

Evaluation

Questions to guide reflection:

- To what level did students achieve the learning outcomes?
- How effective were the activities in helping students to understand key concepts and achieve the learning outcomes?
- How did the teaching strategies and activities facilitate student engagement?
- How could the unit be improved to enhance student engagement and learning?