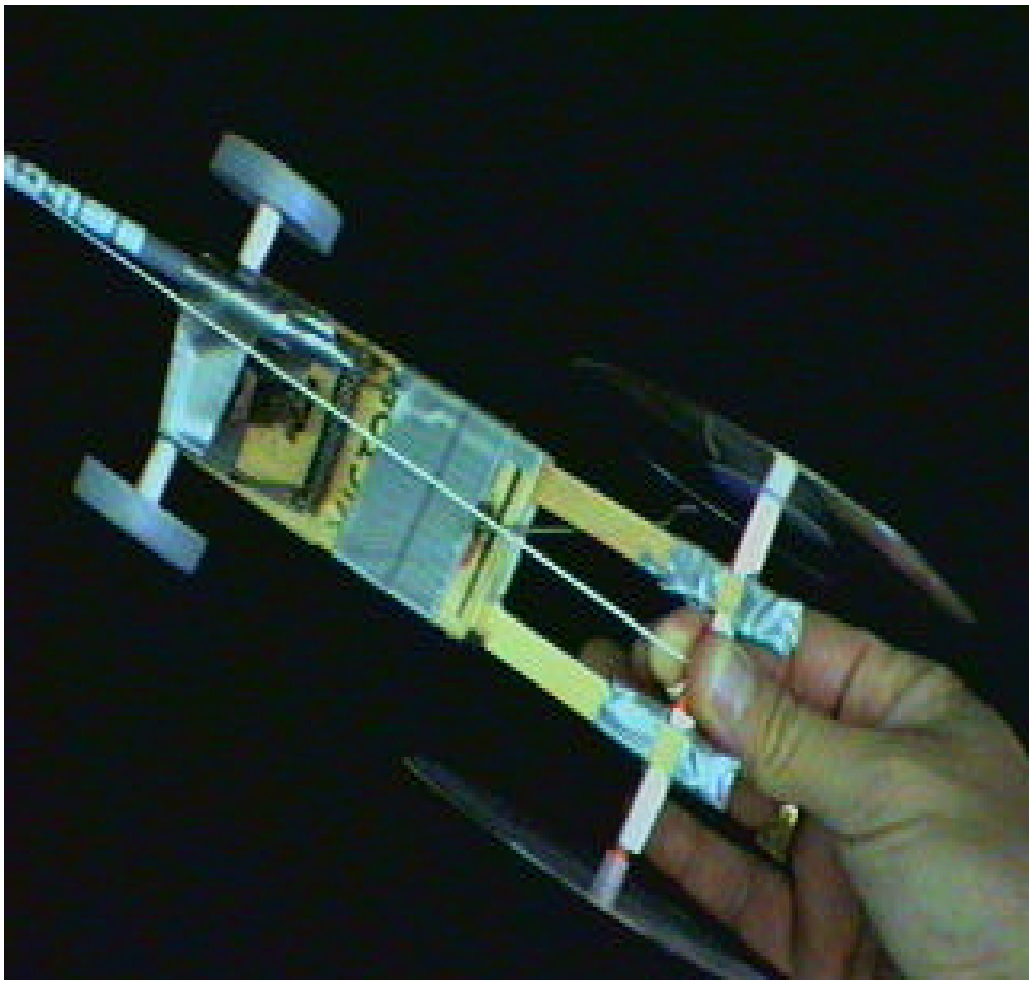
Unit Plan: Mouse Trap Car - Tim Williams

4134 VTA : Energy and Control



Project; Mouse Trap Cars

Description of Project:
For this project, each student will be given the same design-brief, specification and are then to design and build their very own vehicle that is to be powered by the spring movement of a mouse trap. Students are to use preexisting interlocking block modeling systems i.e. Lego blocks, wheels and pulleys.

Throughout this project students will go through the design process. This will include:

- Investigation
- Generating ideas
- Choosing the best idea
- Developing the idea so it can be made
- Making it
- Testing
- Evaluating it

Context and Situation:
You are on school holidays at home, you have been asked to look after your younger brother who is 9 years old. Both he and you have been given a Technic Lego set. You and your brother are quite creative, so your father set you a challenge to build a vehicle, using the logo set that you have, which is to be propelled by a wooden mouse trap and a piece of string. You have the Internet available for you to research different ideas.

You are to design and build a vehicle using the mouse trap and a piece of string. The vehicle will be assessed by the distance it can travel and the time it takes to travel over a 4 meter distance.

Design Brief:
You are to design and build a vehicle that is to be powered by a wooden mouse trap and a piece of string. The mouse trap that you will be given is 47mm wide and 100mm long. You will be given two mouse traps. You are to build the vehicle using Lego blocks, wheels, axles, pulleys and any other pieces within your set. The vehicle has to have some sort of trigger device so that the vehicle can be held motionless while the spring is fully sprung.

Possible outcomes:
Students are required to make a vehicle that is to be powered by the spring of a wooden mouse trap. Students will be required to study basic engineering forces with teacher led research. Students will build the vehicle using either Lego or Macarno building systems.

Unit Plan: Mouse Trap Cars

Grade: Year 9, Industrial Technology and Design.
Lessons: 5 weeks with 3 x 70 minute lessons per a week.
Topic: Mouse traps cars.

Learning Objectives:

The learning objectives for the mouse trap powered cars are the following:

- To develop an understanding for the holistic design process.
- Develop a solution to solve a real life problem.
- Sketching ideas.
- Develop researching skills using the internet.
- Develop an Understand the properties of basic engineering forces.
- Construct a vehicle using modelling systems such as Lego or Macarno.
- Testing their design for speed over a short distance and the total distance that it can be travelled.
- Evaluating their design once tested.

Introduction:

- Placing a mouse trap within a classroom and ask if any student will place their finger on the target area of the mouse trap when the spring is fully sprung back.
- Showing the students a video which explains the design process.

Cross-Curriculum Links:

- Science: Engineering forces.
- Maths: Mathematical equations to work out forces.
- English: Basic literacy skills to write small paragraphs.
- Graphics: Sketching skills to draw concepts and to show their ideas.

Terminology:

- Design: Situation, Design brief, Investigation, Function, Research, Safety and Justification.
- Engineering: Forces, Tension, Compression, Resultant.
- Solutions: Alternatives, Best solutions.
- Evaluation: Modifications, Changes.

Materials and Resources:

- 2 mouse traps per a student.
- Lego or Macarno building systems consisting of blocks, wheels, axles pulleys etc.
- Student workbooks.
- Measuring tapes.
- Stopwatches.
- Computers connected to the internet.
- Sting.
- Spring scales.

Project Planning:

Organization of Teaching:

Design:

- Students are to watch a video exploring of the design process.
- Students are to briefly visit all components of the design process.
- Researching skills using the Internet.
- Discovering engineering forces and where they exist in the real world.

Make:

- Students are to construct their design using building systems such as Lego or Macarno.

Appraise:

- Students are to test their cars for what time it takes to travel over 4 meters; and the total distance their vehicle can travel.
- Upon testing their vehicle, students are to record; does their car work? Would they be able to modify their design to make their car travel faster over a short distance or to make their car travel a further distance?

Learning Outcomes:

The following learning outcomes where referenced from the **Draft Industrial Technology and Design Education Subject Area Syllabus**; January 2003.

The Mouse Trap Vehicle will use the following organizers for the learning outcomes:

Industrial Systems and Control.

- Nature of industrial systems.
- Techniques for manipulating industrial systems.
- Technology practice.

Central learning outcomes

1. **ISC 4.2** Students identify and explain the logic of systems and subsystems.

How will I asses this learning outcomes:

Students will be assessed upon how well they can explain systems and subsystems;

- Students write and draw diagrams to explain how the spring of the mouse trap works.
- Students are to write and draw diagrams to explain how the spring of their mouse trap will power their vehicle.

2. **ISC 4.3** Students incorporate feedback to refine and modify systems and or subsystems.

How will I asses this learning outcomes:

Students will be assessed upon how well they are able to draw and explain how they will refine or modify a system or subsystem within their vehicle.

- Students will be asked to sketch the systems and any subsystem that they will use on their vehicle.
- Students are to sketch and note down notes for any modifications that they make while they are building their vehicle.

3. **ISC 4.4** Students use technology practice to develop industrial systems.

How will I asses this learning outcomes:

This learning outcome will be assessed by using the **Level 4 Technology Practice Outcome** from the **Years 1 to 10 Technology Syllabus.**

4. **ISC 4.5** Students explain different energy sources and can identify their use in simple systems.

How will I asses this learning outcomes:

Students will be assessed upon how they are able to draw and write how they can identify different energy sources and can explain their use within their project.

- Students will be asked to explain how they are going to use the energy source of the spring to propel their vehicle.

Technology Practice

- Investigation is carried out top gather knowledge, ideas and data for use in meeting challenges.
- Ideation is undertaken to generate and communicate ideas that meet design challenges, and to justify the selection of these ideas.
- Evaluation is undertaken to make judgements about the appropriateness of design ideas, processes and products meeting design challenges.

Central Learning Outcomes:

1. **TP 4.1** Students use consultative methods to gather knowledge, ideas and data when researching alternatives within design challenges.

How will I asses these learning outcomes:

Students will be assessed upon what sources of information were used to research information for the investigation of their design challenge.

- Has the student used consultative methods to gather knowledge, ideas and data when researching for alternatives for their vehicle?
  What sources of information did the student use for their research.

2. **TP 4.2** Students generates ideas through consultation and communicate these in detailed design proposals.

How will I asses this learning outcomes:

Students will be assessed upon how well they are able to generate different ideas and then being able to draw and explain these ideas in their design proposal.

- Was the student able to communicate their ideas through sketches and writing to express their ideas within their design proposal?

3. **TP 4.4** Students gather feedback to gauge how well their design ideas and processes meet design challenges and how effectively products meet the needs of specific users.

How will I asses this learning outcomes:

Students will be assessed upon how well they were able to evaluate their vehicle to the design brief.

- Was the student able to evaluate their project using the following questions:
  1. Did their design work?
  2. Does it meet the design brief?
  3. Will modifications improve the solution?
- Did the student provide sketches showing how they would modify their design?

Procedure:

The below procedure may vary depending upon the ability of the group.

While teaching these lessons, I will incorporate the following teaching strategies to help teach both the whole group and individual students, who could be at risk, so that they develop a better understanding for the project.

Teaching strategies that I will incorporate while I'm giving whole class discussions will incorporate the following:

1. All students will be placed at single desks around the room so that every person has a clear line of sight to watch the teacher.

2. All students to remove all objects from their hands; this will stop them fidgeting, students loose concentration when they are fidgeting.
3. Ask any students who are not paying attention, questions that relate to the specific skill or concept that is being taught.
4. Repeat important points so that the students remember them.

At risk students will be able to develop to their full potential by applying the following teaching strategies into the general classroom.

1. Within the classroom, I the teacher will rotate around the classroom and approach individual students at their desk to see if they are having any difficulties.
2. With every concept, I will ask each student individually to see if they have any problems and do they fully understand the concept which is trying to be discovered.
3. Pairing advanced students with students who are struggling; this will allow the advanced student to help teach the struggling student developing their understanding further while keeping them occupied; this will help the struggling student to keep up with the class.

Weekly Planner

Week 1

- Students will be introduced to the mouse trap cars.
- Students to be shown a video on the design process.
- Students to be given a lesson on researching information on the internet.

Week 2

- Students are to conduct their research for the investigation of the design challenge.
- Students to have a lesson on basic engineering forces.
- Students to sketch their ideas for their vehicles.

Week 3

- Students to develop their ideas for their best solution.
- Draw their best solution and the justification for their choice.

Week 4

- Students are to construct their vehicles.
- Students are to begin testing and modifying their vehicles readying for racing.

Week5

- Students are to race their vehicles for speed over 2 meters and for total distance travelled.
- Students are to evaluate their vehicle.

Assessment:

Students will have their car assessed using the following method:

1. Results gathered from testing. Students will be assessed upon the best result of their car over three runs; for the quickest time it takes for their car to travel over 4 meter and the longest distance their car can travel.

Trial	Distance Moved (M)	Time for 2 Meters (sec.)
1.		
2.		
3.		

Students will be given extra credit points upon how well their car performs. The student who has the greatest number of points within the class will be classed as class champion. Student with the greatest over the grade will be classed as that Years Champion.

Credit:
(1) Any car that moves at least 2 Meters... 25 points
(2) Any car that moves 4 Meters or more.... 50 points
(3) Fastest car in a class ..... 75 points
(4) Fastest car in all classes ..... 100 points
(5) Longest distance car in a class ..... 75 points
(6) Longest distance car in all classes ..... 100 points

Their will also be certain standards from which the mark's will be awarded.

Distance moved:

A	8 meters or greater
B	6 meters though below 8 meters.
C	4 meters though below 6 meters.
D	2 meters though below 4 meters
E	Fails to travel less then 2 meters.

Time to travel over 4 meters:

A	Takes less then 2 seconds to travel the 4 meters.
B	Takes more then 2 seconds though under 4 seconds.
C	Takes more than 4 seconds though under 6 seconds.
D	Takes greater than 6 seconds to travel over 4 meters.
E	Fails to travel through the 4 meters.

The performance of the vehicle is worth 40 % of the overall rating for the project.

2. Students will be graded on the overall construction of the vehicle.

The overall construction of the project is worth 20 % of the overall rating for the project.

3. Students will have their design folio marked using the criteria below

Outcome	**A**	**B**	**C**	**D**	**E**
ISC 4.2 Students identify and explain the logic of systems and subsystems.					
ISC 4.3 Students incorporate feedback to refine and modify systems and or subsystems.					
ISC 4.4 Students use technology practice to develop industrial systems.					
ISC 4.5 Students explain different energy sources and can identify their use in simple systems					
TP 4.1 Students use consultative methods to gather knowledge, ideas and data when researching alternatives within design challenges.					
TP 4.2 Students generates ideas through consultation and communicate these in detailed design proposals.					
TP 4.4 Students gather feedback to gauge how well their design ideas and processes meet design challenges and how effectively products meet the needs of specific users.					

The design folio is worth 40 % of the overall rating for the project.

This table shows what the total marks are for the project.

	Weighting %	**Your Marks %**
Design Folio	40 %	
Vehicles Performance	40 %	
Overall construction	20 %	
	Total % for the Project	

Bibliography:

1. Queensland Studies Authority. *Industrial Technology and Design Education Subject Area Syllabus: Level 4 to Beyond Level 6.* Queensland Studies Authority, Brisbane. January 2003.
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INDUSTRIAL
TECHNOLOGY & DESIGN

YEAR 9

Design

Name: _____

Mouse Trap Car

Work Book

The Problem

Context and Situation:
You are on school holidays at home, you have been asked to look after your younger brother who is 9 years old. Both he and you have been given a Technic Lego set. You and your brother are quite creative, so your father set you a challenge to build a vehicle, using the logo set that you have, which is to be propelled by a wooden mouse trap and a piece of string. You have the Internet available for you to research different ideas.

You are to design and build a vehicle using the mouse trap and a piece of string. The vehicle will be assessed by the distance it can travel and the time it takes to travel over a 4 meter distance.

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Possible outcomes:
Students are required to make a vehicle that is to be powered by the spring of a wooden mouse trap. Students will be required to study basic engineering forces with teacher led research. Students will build the vehicle using either Lego or Macarno building systems.

Investigation

Using the internet; you are to research as many ideas for how your car will be powered by the spring. If you found any ideas on the internet, you must reference the site that you got them from. Draw three different ideas of how you are going to use the spring to propel your car. Write briefly what the idea you have drawn is about.

Design of the car

You are to develop three different designs for the body of your car. Sketch your ideas and write some comments about each idea. Write what you like about that design and what you don't like.

What concepts are you going to use to transfer the power of the spring to turn the axle

You are to sketch three different ideas of how you are going to use the piece of string to power the axle. Label the features of your different designs.

You are to choose which idea you are going to use the string to transfer the power of the spring to the axle of the car. Justify your choice.

Choosing your best solution

You are to choose your final solution. Sketch the design showing overall dimensions. You are to write brief notes explaining the features of your design.

You are to justify the choices you have made on your design car.

Testing

Students will test their car using the following method:

Students will be testing their car over three runs; for the quickest time it takes for their car to travel over 4 meter and the longest distance their car can travel.

Trial	Distance Moved (M)	Time for 2 Meters (sec.)
1.		
2.		
3.		
Your best result		

Below is the standard for how your car will be assessed.

Total distance covered:

A	8 meters or greater
B	6 meters though below 8 meters.
C	4 meters though below 6 meters.
D	2 meters though below 4 meters
E	Fails to travel less then 2 meters.

Time to travel over 4 meters:

A	Takes less then 2 seconds to travel the 4 meters.
B	Takes more then 2 seconds though under 4 seconds.
C	Takes more than 4 seconds though under 6 seconds.
D	Takes greater than 6 seconds to travel over 4 meters.
E	Fails to travel through the 4 meters.

Evaluation

Now that you have raced your car, you are to answer the following questions.
Was your car successful?

While you were building your car, did you make any changes to your car from the best design? Write and or sketch these change.

Would you make any modifications to your design if you were to make the car again? Sketch any changes.

Bibliography

You are to write down every resource you used in the research for this project. These could include books, magazines or web sites.

Assessment

You will be assessed using the following criteria.

Your car will be marked by its performance on race day.

Trial	Distance Moved (M)	Time for 2 Meters (sec.)
1.		
2.		
3.		
Best performance		
Grade		

This is the standard by which you will be assessed upon:

Distance travelled:

A 8 meters or greater
B 6 meters though below 8 meters.
C 4 meters though below 6 meters.
D 2 meters though below 4 meters
E Fails to travel less then 2 meters.

Time to travel over 4 meters:

A Takes less then 2 seconds to travel the 4 meters.
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Students will have their design folio marked using the criteria below

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TP 4.2 Students generates ideas through consultation and communicate these in detailed design proposals.					
TP 4.4 Students gather feedback to gauge how well their design ideas and processes meet design challenges and how effectively products meet the needs of specific users.					

Your car will be assessed for its overall construction. Below are the criteria for this.

Criteria	A	B	C	D	E
The final presentation of your car.					
The level of difficulty of your cars construction.					

This table shows what the total marks are for the project.

	Weighting %	Your Marks %
Design Folio	40 %	
Vehicles Performance	40 %	
Overall construction	20 %	
	Total % for the Project	

Teacher's comments:

_____
_____
_____
_____
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