

ST JOHNS COLLEGE

Course Title: Sustainable Transportation

Year 12 Curriculum Level: 7

Focus - Technology Components

- Brief Development
- Planning for Practise
- Outcome Development and Evaluation (Prototype)
- Technological Products
- Construct a Resistant Materials Product

COURSE DURATION

One year course, 32 weeks, 4 x 60 min periods per week.

COURSE DESCRIPTION

Working with the Hamilton City Council, students are introduced to transport issues that contribute to the city's ever increasing traffic congestion. Students meet with a City Planner and Sustainable Travel Co-ordinator to discuss transport issues within the city and initiatives being introduced to address these issues. Students are then given the opportunity to identify transport issues that directly affect them. Students undertake brief development, select and use appropriate planning methods to develop a materials outcome that assists to address their identified transportation issue.

This Unit Links to the Following Achievement and Learning Objectives

Technological Practise Components

Brief Development

Level Seven:

Justify the nature of an intended outcome in relationship to the issue to be resolved and justify specifications in terms of key stakeholder's feedback and wider community considerations.

Planning for Practise

Level Seven:

Critically analyse their own and others' past and current planning and management practices in order to develop and employ project management practices that will ensure the effective development of an outcome to completion.

Outcome Development and Evaluation

Level Seven

Critically analyse their own and others' outcomes and evaluative practices to inform the development of ideas for feasible outcomes. Undertake a critical evaluation that is informed by ongoing experimentation and functional modelling, stakeholder feedback, and trialling in the physical and social environments. Use the information gained to select, justify, and develop an outcome. Evaluate this outcome's fitness for purpose against the brief. Justify the evaluation using feedback from stakeholders and demonstrating a critical understanding of the issue.

Technological Knowledge Component

Technological Modelling

Level Seven

Understand how the "should" and "could" decisions in technological modelling rely on an understanding of how evidence can change in value across contexts and how different tools are used to ascertain and mitigate risk.

Construction and Mechanical Technologies

Construct a Resistant Materials Product

Level Seven

Implement advanced procedures to make a resistant materials product.

COURSE STRUCTURE

Brief Development

Using our Local Authority as a stakeholder, as well as community input, students develop a brief that identifies and outlines a transportation issue (e.g. transportation to and from school bus stops, sports trainings, recreation within our city etc) and a proposed outcome. Attributes are identified from surveying stakeholders, these are researched and specifications are generated.

Planning for Practise

Students critically analyse their own and others' past and current planning and management practices in order to develop and employ project management practices that will ensure the effective development of an outcome to completion. Students select and use appropriate planning tools to guide their development and outcome to a completed prototype.

Outcome Development and Implementation

Guided by their brief, students will critically analyse existing sustainable transport options to inform their decision making and eventual outcome. During their practise they will produce and model conceptual ideas, investigate and test materials, test manipulation processes, evaluate and select suitable components and develop a final prototype and test it in situ.

Learning Outcomes

Students will:

- Develop a brief that identifies their selected transportation issue and justify their intended outcome.
- Evaluate, select and use appropriate planning tools to ensure effective development of their final outcome.
- Research and identify a selection of existing sustainable transport outcomes. Information is identified relating to function, materials and manipulation processes used to create the outcome.
- Develop sketches that communicate design features and use functional modelling to effectively test their design ideas.
- Test a series of materials, processes and components and make decisions that will assist to develop and trial a prototype designed to meet their brief.
- Evaluate the fitness for purpose of the final outcome against the brief.

COURSE OVERVIEW

Exploring the Concept of Sustainable Transport

Initial introduction to this unit is carried out by:

- Class discussion covering unit and introduction to sustainable transport.
- Identify the concept of sustainable energy and identify options.
- Identify existing vehicle options (e.g. electric cycles and scooters, human powered cycles, bio diesel vehicles).

Introduction to Major Stakeholder, Hamilton City Council

- Organise a visit from HCC Sustainable Travel Co-ordinator and City Planner.
- City Planner identifies traffic congestion issues within Hamilton and reasons for this (one person one car commuters, parking issues in the central city, housing growth on the east side of the city while work opportunities are increasing on the west side of the city, restrictions that occur from the river that passes through the centre of Hamilton) . Also looks at future problems that may occur.
- Sustainable Travel Co-ordinator introduces students to Council initiatives being introduced that will help address issues within the city (promotion of cycling, developing a user friendly environment for cyclists, increased bus services).
- Council also brought in an electric cycle to demonstrate sustainable options that are being evaluated for Council use.

Brief Development

At year 11, students are not required to produce individual briefs but are supplied with an initial teacher generated brief which they further develop. To address the step up to year 12, brief development becomes a major focus for this unit with an emphasis placed on the identification of individual transportation issues within the city.

- Students critically evaluate the two aspects presented by HCC staff visit (traffic congestion, ideas to alleviate the problem). Key points are documented which will become the basis of their brief development.
- Students are given the task to identify and work with a group who are affected by one of the issues identified by the HCC (these people will become their stakeholders).
- A formal lesson is delivered covering surveys and questioning techniques (open, closed questions, evaluating answers etc).
- From the HCC visit, stakeholder surveys and their own input an initial brief is generated comprising a conceptual statement and initial attributes. At this stage students are told that their initial brief will change and grow as their practice evolves.

Stakeholder Identification

Resources used: *Resistant Materials Technology, questioning techniques.*

The importance of identifying and using stakeholders is discussed:

- Stakeholders are selected for their ability to have an input into this unit as commuters within our city. They will also assist with ongoing evaluations and testing when required.
- Reasons for stakeholder input and how we use this information is also covered.
- Students then identify and justify their stakeholders, produce and action surveys and evaluate their feedback which is then used to start to build their initial brief.

Brief Development

From stakeholder's surveys, including information from HCC, students generate an initial brief.

- A conceptual statement is produced that outlines the issue identified and an indication of the proposed outcome.
- Attributes are identified from stakeholder surveys.
- Students identify and carry out attribute research.
- Research is then carried out to generate specifications for a revised brief.
- Working from the revised brief students generates a selection of concept ideas.

Planning

Resources used: *Resistant Materials Technology, www.technologystudent.com, www.googleagantproject www.smartdraw*

Planning is introduced and discussed.

- A lesson on planning is delivered initially revisiting planning methods and tools used at year 11.

- A selection of new planning tools is introduced to the students. The new planning tools are then evaluated and links are identified between the new planning tools and the student's proposed practice. These planning tools are made available to students on our school system.
- We have a visit from a local technologist who presents to the class his perspective on planning, how and why it is carried out within his company and further introduces planning tools that could be used by our students. For this visit to be successful it is important that the visiting technologist have prior knowledge of the depth of knowledge students presently have regarding planning and planning tools and NCEA Achievement Standard requirements. Our technologist has also made himself available to our students for ongoing consultation. An additional link is made with the terminology used by the technologist to support the terminology used by students. Students can make the links between industry and school.
- For the remainder of the unit, with support, students select, justify and use planning tools that have been made available to them as well as any they have identified (AS 2.2).

Outcome Development

Technologist's Visit

- At this stage a manufacturing technologist visits and introduces students to the Aqua Cart which is a mountain bike powered amphibious vehicle. The technologist covers the following.
 - The initial development of the issue.
 - Methods used to model and test the initial ideas.
 - Development of components and generation of materials specifications specifically for the gearbox components.
 - He explains and shows how, through modelling and testing, the gear box has evolved to its present stage.
 - Discussion is generated covering ongoing servicing and overhaul of the gearbox when in service.
 - Component selection in relationship to manufacturing and the use of off-the-shelf parts such as bearings, fastenings etc to assist with ongoing maintenance is also discussed with good examples made available to the students.
 - Examples of modelling and testing also supports information for A/S 91358
 - Life expectancy of materials is discussed along with recycling options for materials.

Existing Product Research (Knowledge Strand, Technological Products)

Students produce research information that identifies (existing products).

- Possible outcomes that could fulfil the requirements of their brief.
- Materials used in the above outcomes and manipulation processes used to construct the outcomes.

- Components used including fastenings and consumable components such as tyres etc.
- Students are encouraged to identify possible maintenance issues, including ease of maintenance (wheel removal, bearing replacement etc).

Prototype Development.

Students work through the development process identifying and documenting information when required.

- Initial design ideas are produced (making on paper) that cover sketches and annotation solving initial design problems. Aspects considered during this stage are designing for function, manufacturing and ongoing maintenance. Students consider simplicity of design, ease of manufacture and assembly, and ease of maintenance including replacement of consumable parts such as bearings, bushes, wheels etc.
- Functional modelling is encouraged at this stage. Cardboard or MDF wood models are used to determine sizes, shapes, etc. 3D computer modelling is also encouraged.
- As much hands on development as possible is encouraged including materials and process testing (a week is put aside for students to revisit previous skills they have learnt as well as new ones including welding processes, lathe work, laminating of timbers and some basic composite work). It is not important to document this stage as it is a learning exercise and students will use and document this when necessary.

Materials Knowledge and Manipulation Testing: AS 2.4

Resources used: *GCSE Resistant Materials Technology for OCR, Skills in Resistant Technology*. www.technologystudent.com

The step up from year 11 to year 12 for this unit is the individual aspect. Each student's outcome will be different in the respect that this unit allows for a range of transportation issues to be developed. The following materials knowledge covered at year 11 is revisited, including: terminology, properties of materials and materials available. This unit allows for a wider range of materials and components to be used including a recycled option.

A formal lesson covering materials and processes identification is delivered. Students identify and document individual components of their concept idea and document performance criteria e.g.

- The frame must support a maximum weight of 100kgs.
- The frame must have the ability to have components mounted to it.
- The frame must contribute to a final operational weight for the prototype of no more than 15 KGS.

Students further consider properties of materials that will allow the performance properties of individual components to be achieved, such as tensile strength, environmental

resistance, other aspects are considered such as ability to manipulate, cost, ability to be recycled and availability.

Students compare and test a range of materials against the above criteria and select appropriate materials.

This type of testing allows for hands on activities while utilising time. Generally evidence is recorded using photographic evidence with students producing personal summaries.

Component Testing and Selection

Component specifications are determined and documented; specifications are generated from attribute research.

Suitable components are identified from product information and also identified from existing product research. Components may be new or recycled. It is important to refer to information generated from our technologist's visit relating to purchasing of off-the-shelf components. This allows for ease of maintenance, extended life expectancy of the project and also reduces costs.

Photographic evidence of testing, summarising of product information and documentation of final selection is required for evidence.

Materials, Components and Dimensions are Determined

- Final materials and component selection is determined and documented.
- Lesson revisiting basic orthographic drawing conventions is delivered.
- Students produce working drawing. Students are given the opportunity to add extra information to their working drawings as construction progresses.

Construction

Resources used: *GCSE Resistant Materials Technology for OCR, Skills in Resistant Technology*. www.technologystudent.com

A formal lesson is delivered covering the following:

- Information from our technologist's visit covering construction schedules and allocation of resources is revisited.
- Students justify the selection of their construction planner which is then used to allocate time resources and schedule construction phases.
- Resources are allocated to coincide with appropriate construction phases.
- Students construct prototype.
- Construction planner is revised at regular stages during construction of the prototype.

- During the construction stage students are encouraged to test aspects of their design as they develop. If possible the prototype should be tested for function prior to final painting and assembly. This will allow for modifications to be carried out before the final surface application is applied and assembled.

Implementation and Testing

On completion of construction a class discussion is generated covering testing of their prototype for fitness for purpose. (Hand-out supplied to students.)

- Students identify testing required (brief specifications) and produce a testing schedule to support the implementation process. It is an advantage to discuss this with stakeholders prior to testing and implementation. Stakeholders are required to be involved in the testing and are given the opportunity to give feedback on the prototypes performance.
- Students summarise testing outcomes and stakeholder feedback and produce a final evaluation summarising the prototypes fitness for purpose. Document any refinements, modifications required if the prototype is deemed not acceptable as a final outcome.

This Unit Link to Achievement Standards

Implement basic procedures using resistant materials to make a specified product

AS: 91354. Undertake brief development to address an issue.

AS: 91355. Select and use planning tools to manage the development of an outcome.

AS: 91357. Undertake effective development to make and trial a prototype.

AS: 91057. Implement basic procedures using resistant materials to make a specified Product.

Assessment Resources Used

Common assessment guide for Technology AS 91358 (2.5).

NZQA Technology – annotated exemplars Level two.

NZQA Technology - assessment resources level two.