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A Contextualised Literacy Intervention in the Foundation Engineering Programme at WelTec

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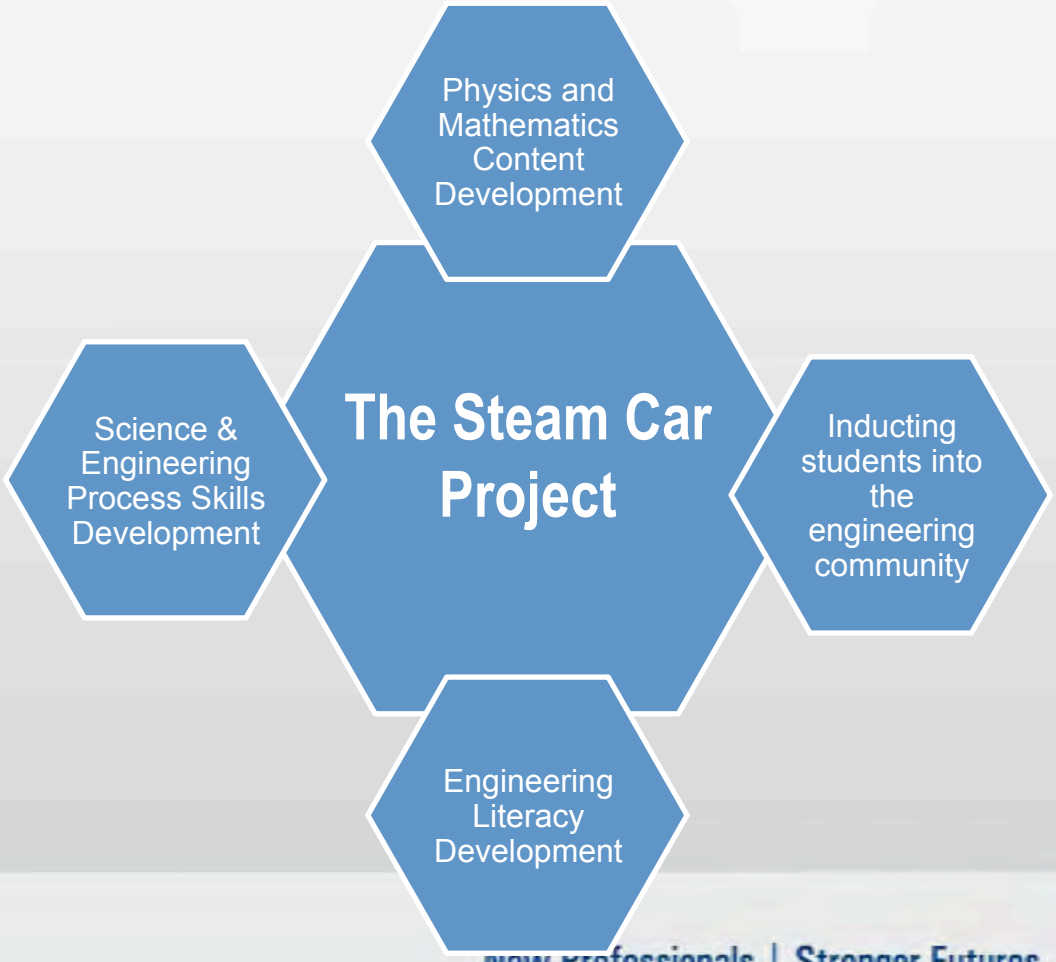
The Context

- Engineering Foundation course (Four week 20 credit; level 4)
- 23 students: Includes school leavers, mature students, non-English speakers, variety of cultures
- Pre-diploma and pre-degree students together
- Practical oriented; project based learning
- Integrates literacy and numeracy development into coursework

Project Based Learning



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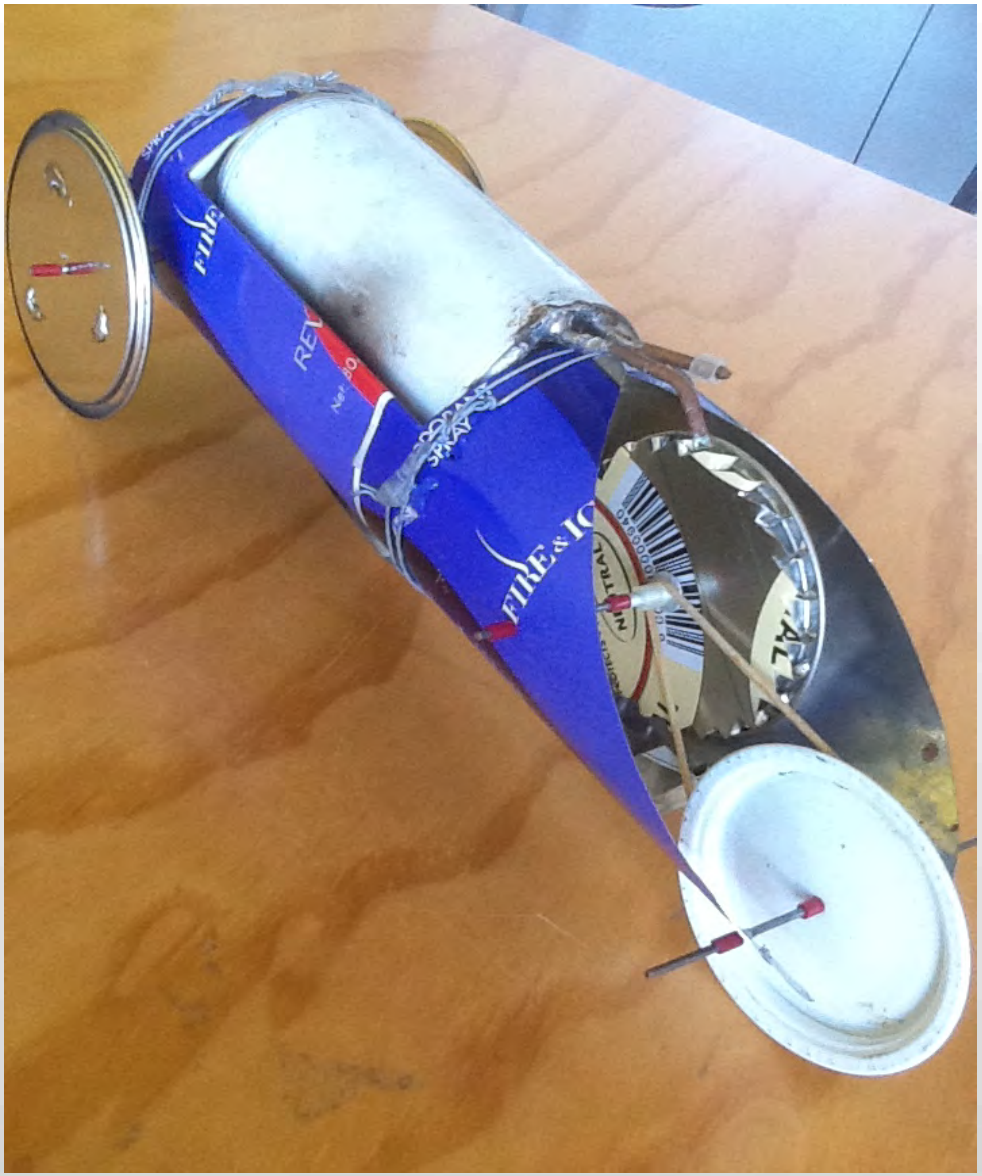
Teaching and Learning Philosophy

- Constructivist approach to learning
- Project Based Collaborative learning model
- Embedded literacy and numeracy
- Developing self-efficacy



The Steam Car Project

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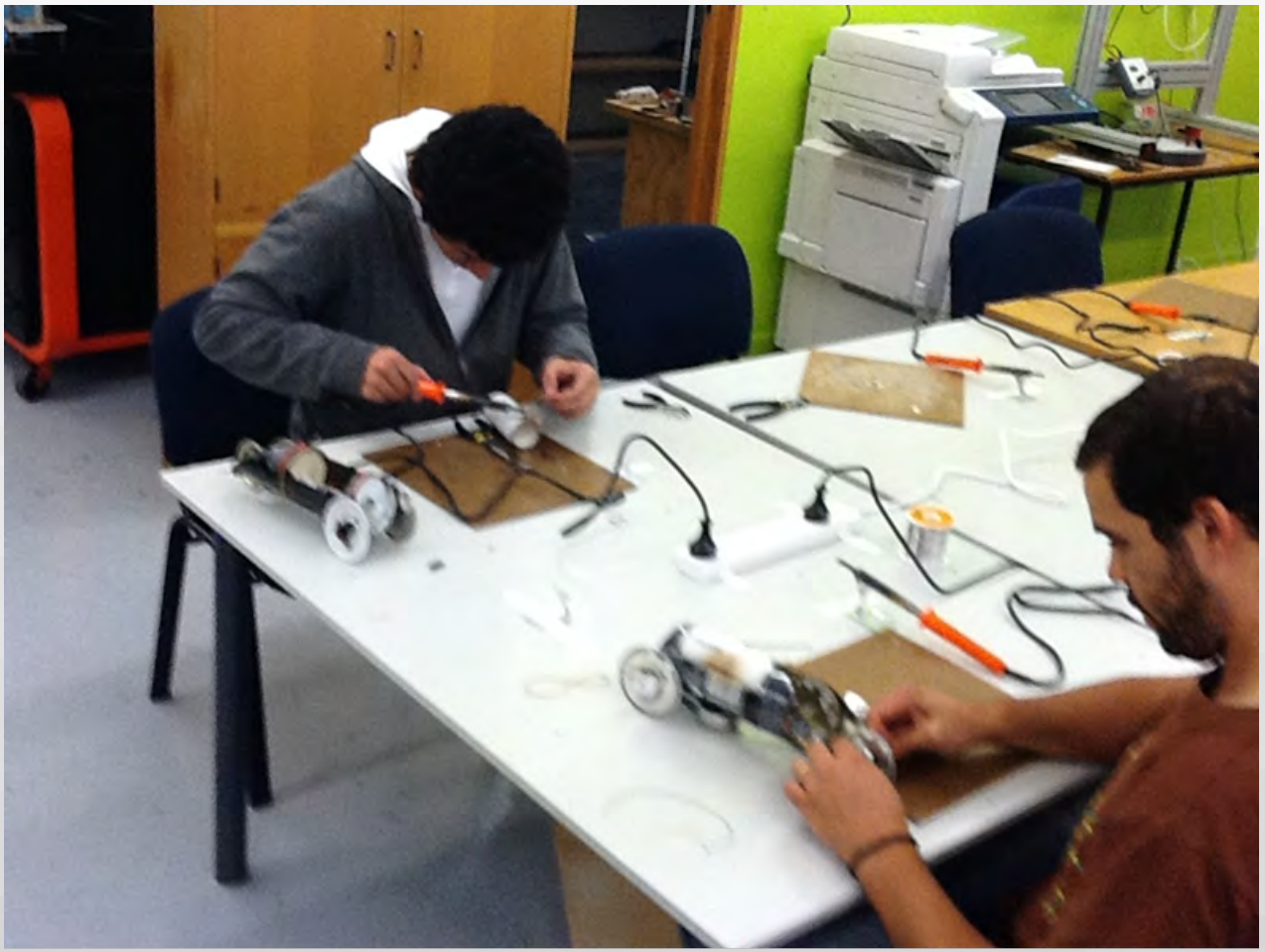
Stages in the Steam Car Project

- Making the cars
- Testing the cars and calculating the efficiency
- Designing a modification to improve efficiency
- Testing the modification
- Writing a report
- Converting the car into a steam generator

Making the cars



Testing the cars and calculating the efficiency

In this video clip, students are using a strobe to measure the rate of rotation of the turbine.

Designing and testing a modification to improve efficiency

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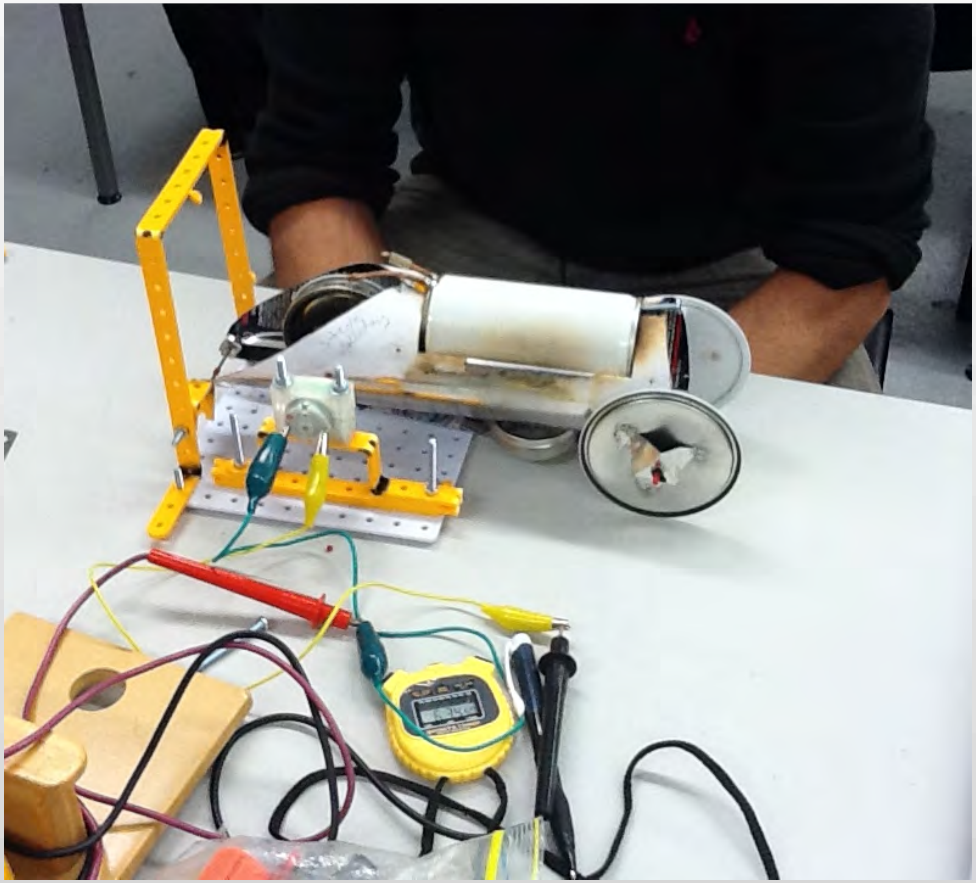
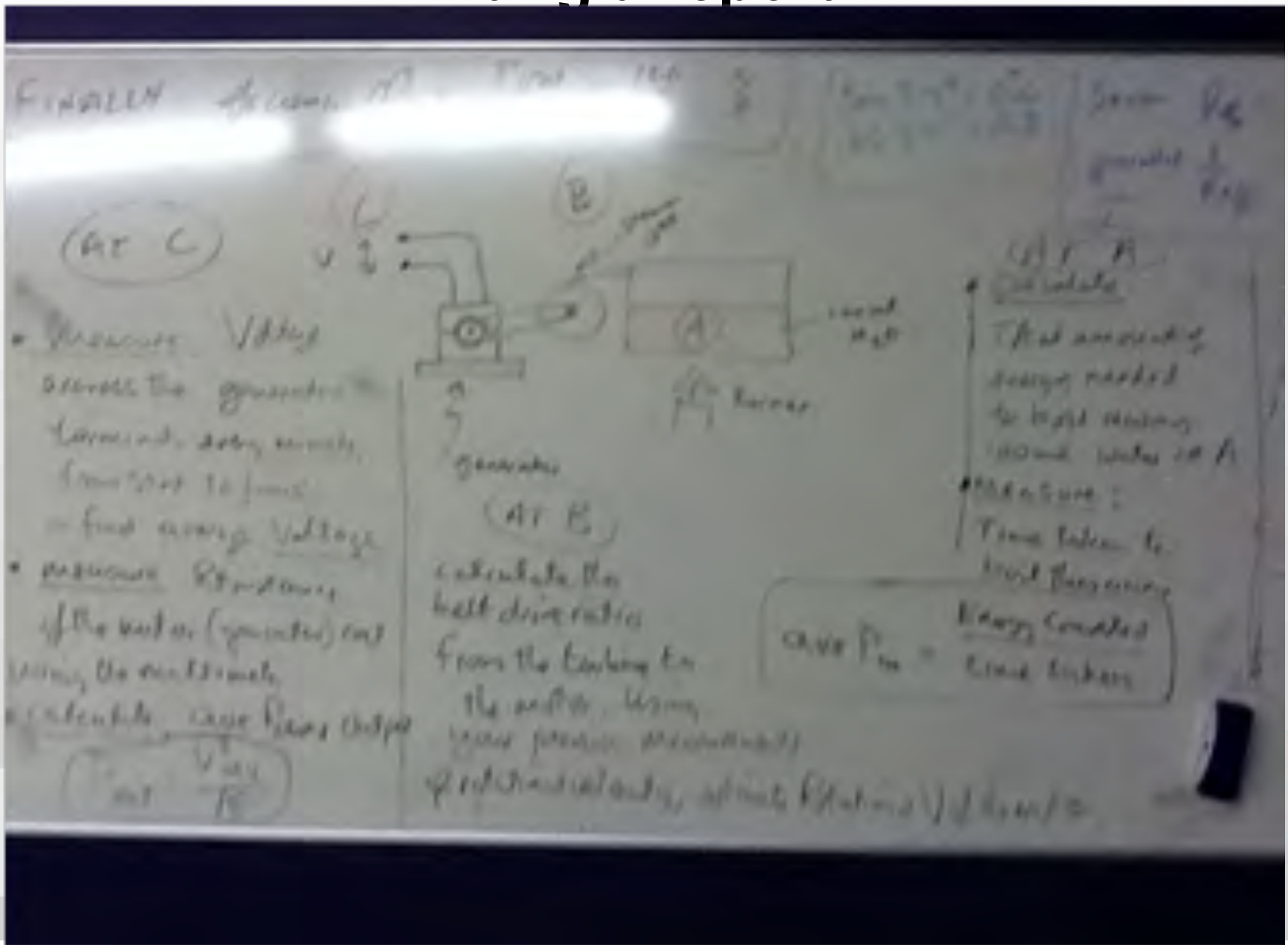
Converting the car into a steam generator



Writing a report



Skills Development (Psychomotor and Cognitive Domains)

Psychomotor Domain

- Making, using tools, using scientific equipment

Cognitive Domain

- Planning work, designing modifications, carrying out instructions, planning and designing experiments

Content Development (Cognitive Domain)

Mathematical Knowledge

- Using ratio and proportion, simple scaling, areas, volumes, basic manipulation of formulae, graphing

Physics Knowledge

- Basic mechanics, force and motion, thermal physics

Inducting Students into Engineering (Affective Domain)

Self-efficacy

Developed through a process of mastery of tasks (Bandura, 1994)

Language

Inducted into the language of Engineering (Learn to talk and write engineering language)

Barriers to learning writing in Engineering

- Taking into account the growing diversity in student population

❖ Technical

❖ Cultural (culturally specific terms)

❖ Engineering Language terms

Language Development within the context of the Steam Car Project

- Reading the instructions
- Writing a scientific report
- Writing an engineering design report

List of Language tasks

- Read instructions
- Informal Discussion
- Write 4 experimental reports
- Write 2 Design Reports

Reading Task

Students required to read and interpret engineering dense language of the kit instructions

MICRO STEAM CAR
Making the Turbine - Final Assembly
INSTRUCTION SHEET 3

Making the Turbine

Final Assembly

Fitting the wheels

Fitting the turbine and pulley

Informal Discussion (talking engineering)

Discussion throughout the process of making and testing the car developed students use of engineering language

Writing

Focus on two genres of report

- Engineering Design Report
- Scientific Investigation Report

The Design Report

The Design Report Structure:

1. Identifying the problem/product innovation
2. Gather the information
3. Brainstorm the solutions and then choose the best one
4. Make the prototype
5. Evaluate the prototype
6. Results
7. Conclusion

(Beer, D. & McMurray, D. 2005. A guide to writing as an Engineer)

Experimental Report

The Experimental Report Structure:

1. The question
2. The Hypothesis
3. The design investigation/experiment to test the theory
4. The method
5. Collection of data
6. Discussion/analysis
7. Reject or accept the hypothesis

(Rosenberg, B.J. 2005. Technical Writing for Engineers and Scientists)

Design Report:
Examples of students reports

- Students reverted back to writing the report like a ‘recipe’
- Tendency to write as if tasked with solely the experimental report

Experimental Report: Examples of students reports

- For majority the standard layout/format was adhered to
- Often missed a step….- going to the conclusions before results or missing the discussion
- Lack of use of the third person singular…lots of ‘we’, ‘I’ use
- Conclusions were often were weak

Findings

- Students loved doing the project, even though they found it difficult
- Students felt like engineers
- Students acquired important engineering and scientific process skills
- Basic numeracy was developed
- Physics knowledge was learned “by the way”
- Students were able in the end to use engineering and scientific language to write their reports

Scaffolding

Scaffolding throughout the project was an important component of the strategy to develop an improvement in content knowledge, process skills as well as language use

Questions?