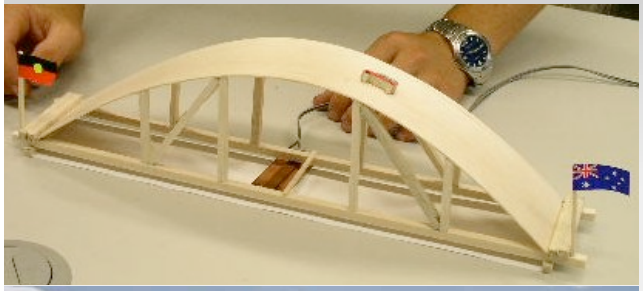
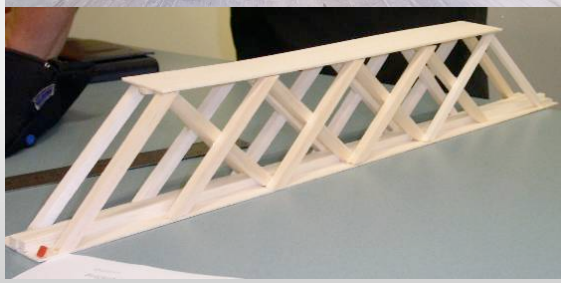
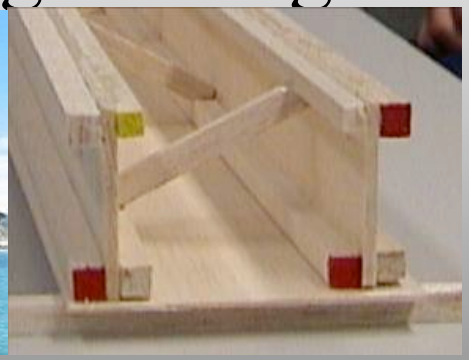
# Bridges to Learning





**Tim McCarthy**

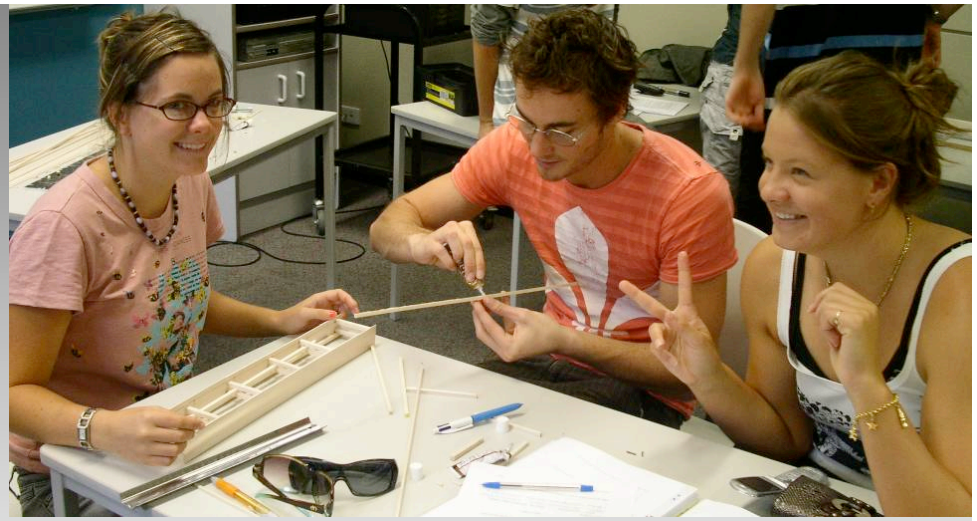
Faculty of Engineering



Enhancing undergraduate engagement through research and enquiry

University of Wollongong Australia

# Agenda for today



- Motivation for New Subject
- Engineering 101
  - Implementation
  - Student Engagement
  - Reflection – Our own learning cycle
- Theoretical support for ENGG101
- Analysis and comparison 2005 Vs 2006
- Conclusion

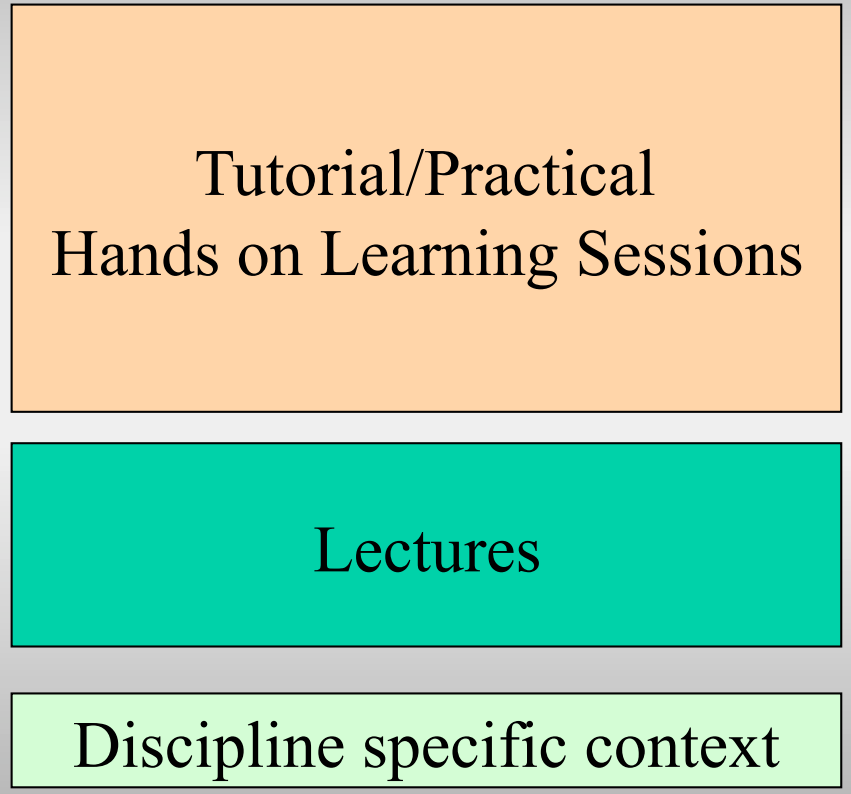
# Background

"You just have to hold your breath until 3rd year"

- Engineering Mechanics subjects
  - theory in structured step by step approach
  - Practical synthesis arriving too late (3rd year)
- Need to demonstrate the context early in the curriculum
- Change the assessment driven approach of students

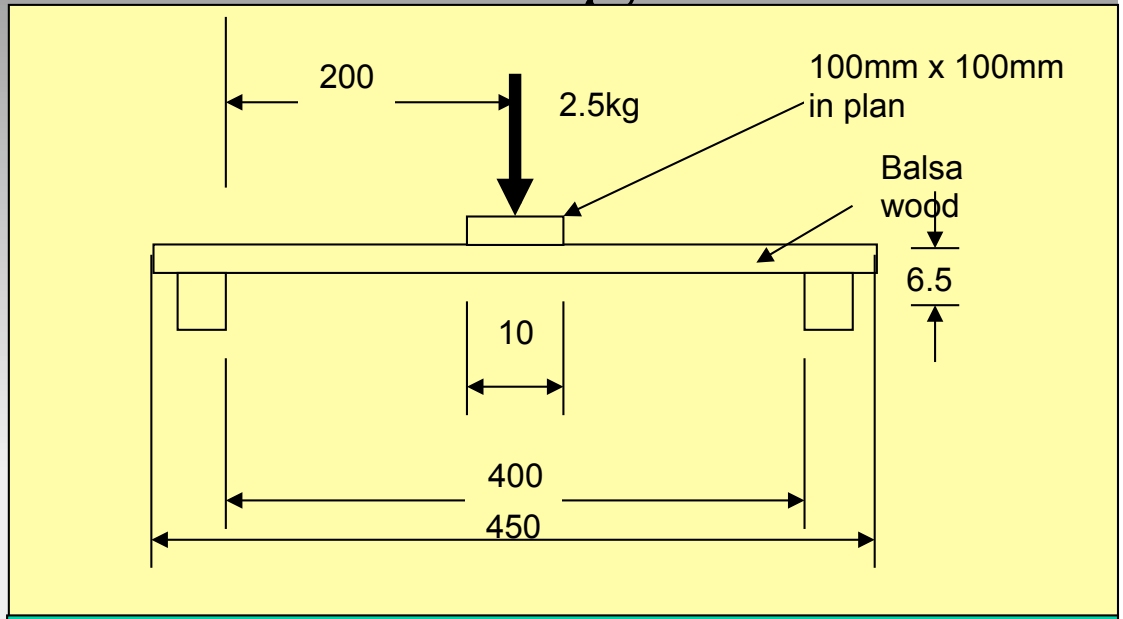
# Design of ENGG101

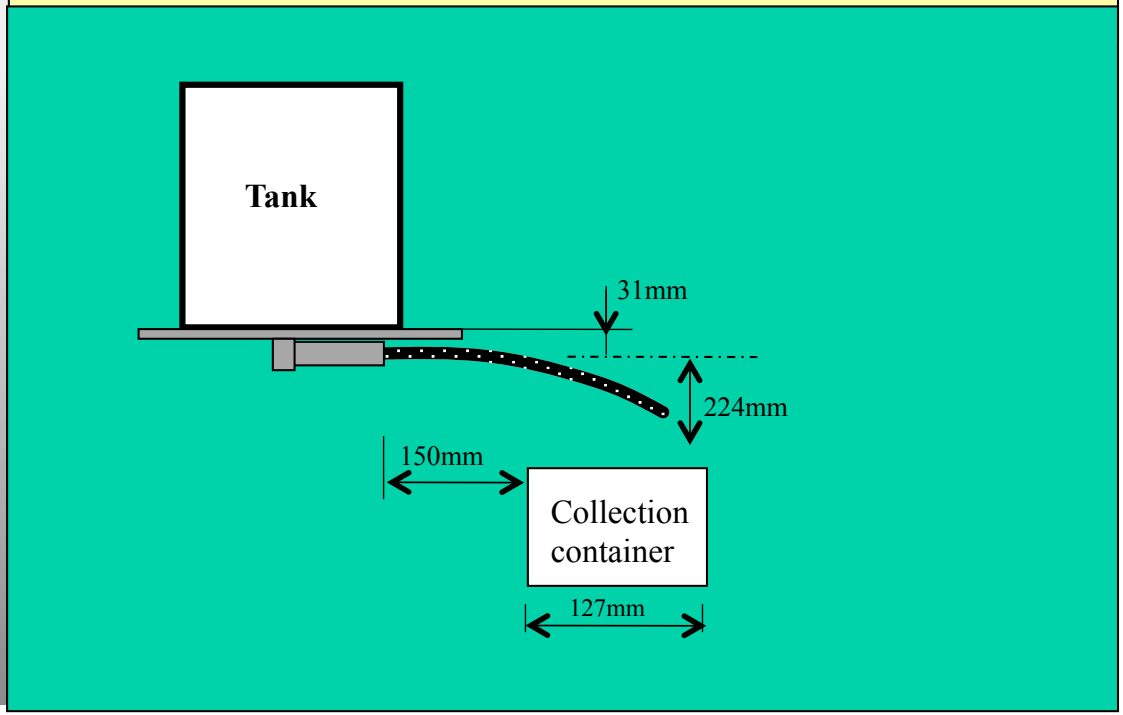
- Core activity in 3 hour hands-on learning sessions
- Lectures provide focus and support for the tutorial/practicals
- Discipline specific seminars/ site visits/ workshops



# Enquiry Based Learning

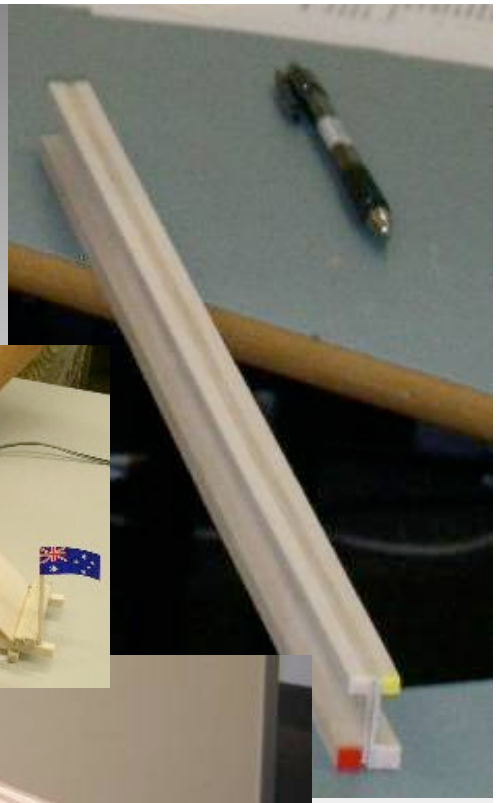
- Two projects
- Project 1
  - Engineering mechanics
  - Create a beam to carry 2.5kg out of balsa
- Project 2
  - Flow processes
  - Water delivery system

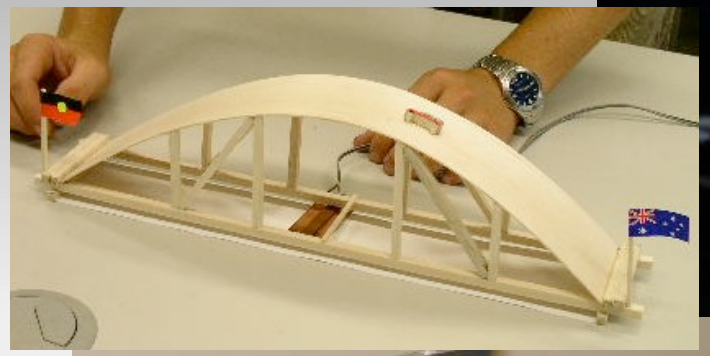


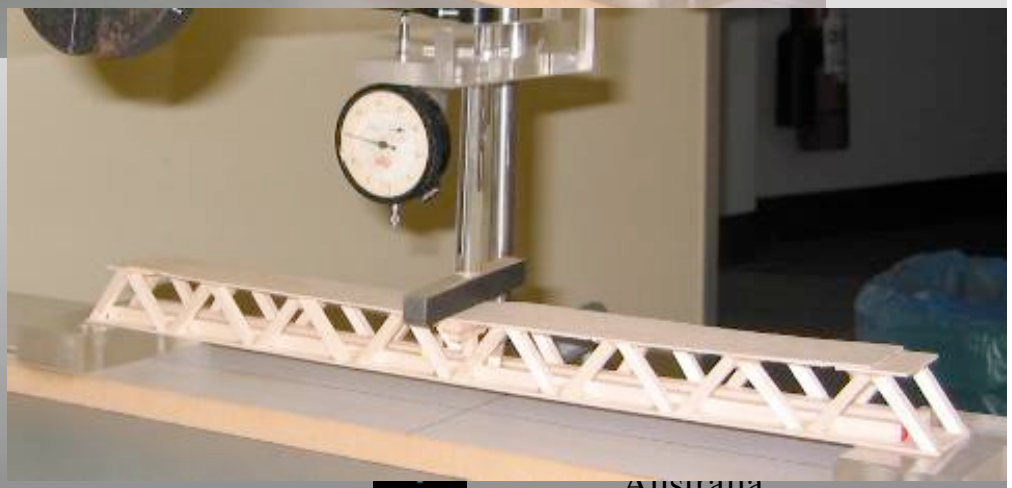



# Project 1

- Day 1 Initial attempt
  - Self selecting groups
  - Wide range of  beams
- Week 2
  - Reflection
  - Identify gaps in knowledge
- Weeks 3-5
  - Fill knowledge gaps
- Week 6
  - Design optimum balsa beam

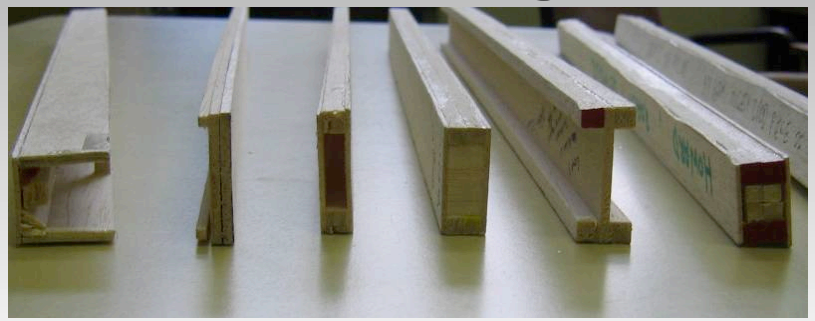


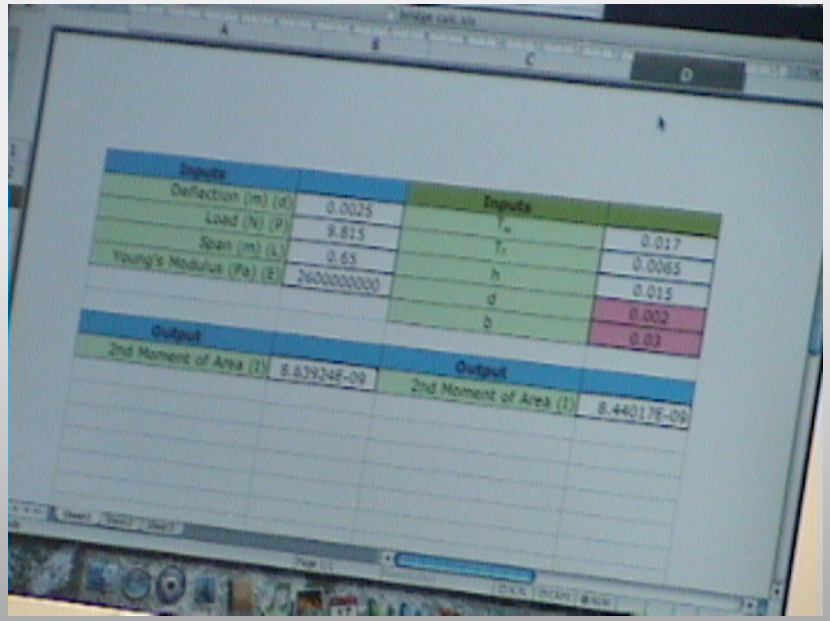




# Project 1 Gaps in Knowledge

- Student reflection reports
- Material Properties
- Beam theory
  - Strength
  - Deflection
- Using spreadsheets
  - Automate calculations



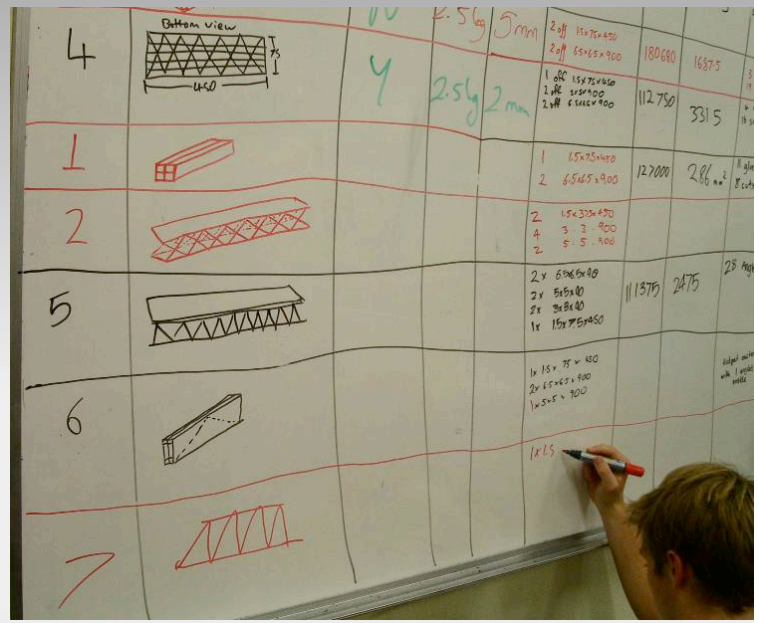


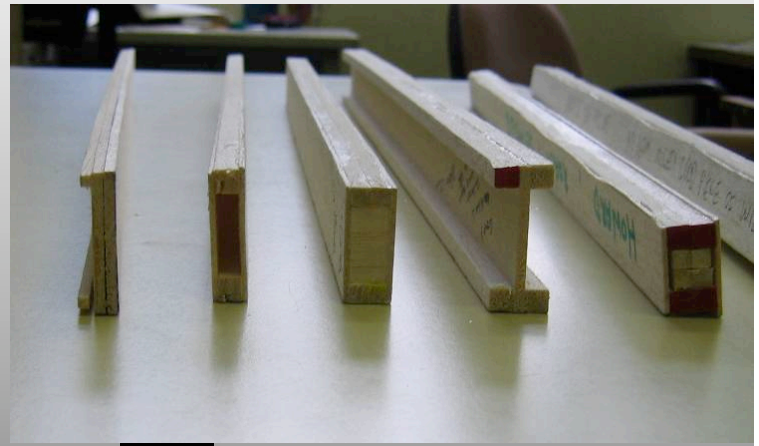
# Week 6 Second attempt

- Students control the design
- Predict performance
- Generalise solution for different parameters
- Justify design
- Assess uncertainties
- Reflect on learning

# Learning cycle

- Immersion
- Reflection
- Research gaps in knowledge
- Design and predict
- Generalise method
- Test and evaluate
- Reflection





# Student responses

- Evaluation questionnaire
  - 210 responses

"Using the concepts learnt in Engineering Studies to solve actual problems was new and rewarding"

"The practicals are fun… I like how it helps me see how engineering works in practice"

"The course was very broad and didn't seem to lead anywhere."

# Our own Learning cycle

- Immersion
- Reflection
- Research gaps in knowledge
- Design and predict
- Generalise method
- Test and evaluate
- Reflection

Initial attempt at ENGG101

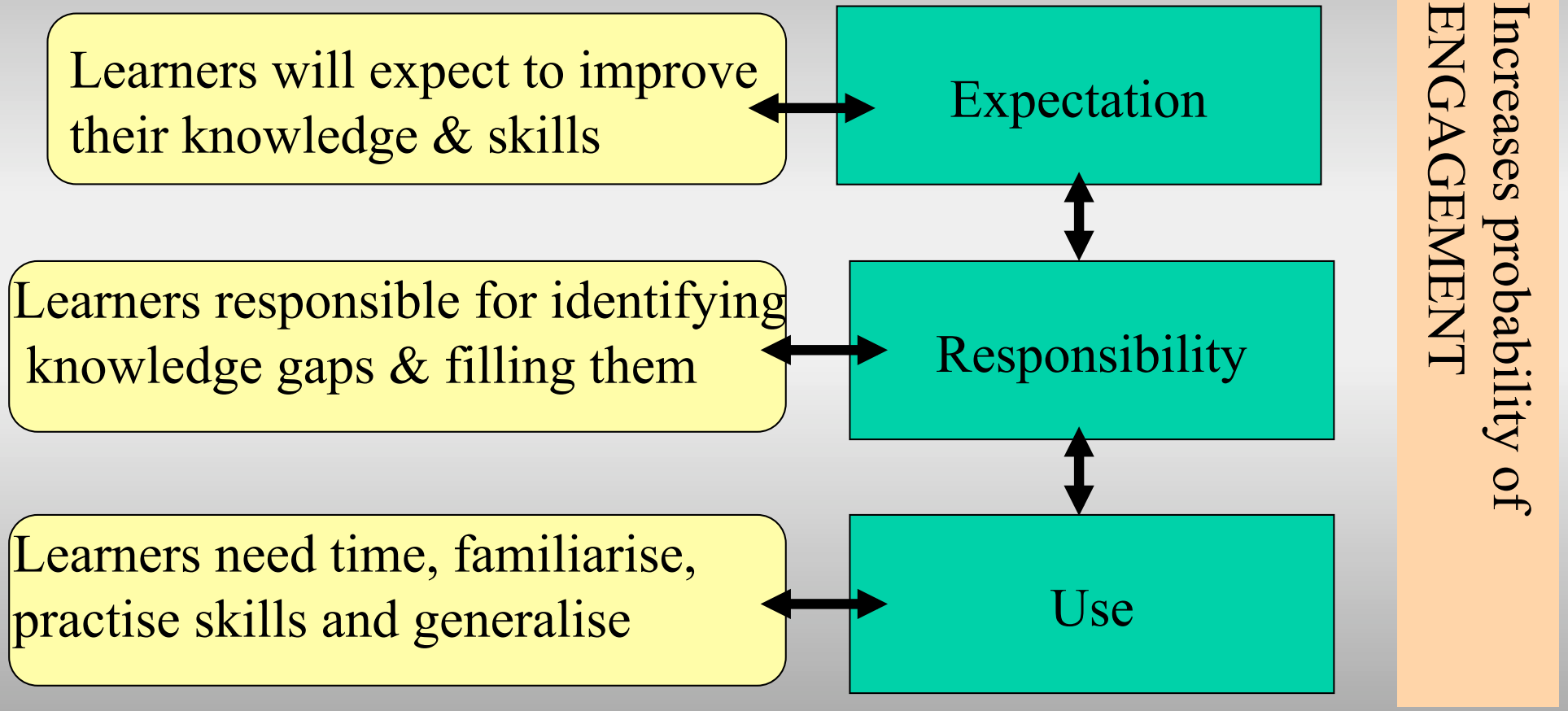
Questionnaire & evaluations

Study educational theories

Apply model to each new delivery of ENGG101

Ongoing activities

# Cambourne's "Rules of engagement" (1988)



# Student responses 2005 & 2006

| Question: ENGG101 has… | Level of agreement 2005 | 2006 |
|---|---|---|
| Caused me to understand how you can use science to solve engineering problems | 79.7% | 95% |
| Helped me to understand fundamental engineering principles | 74.1% | 90.5% |
| Caused me to feel confident in tackling unfamiliar problems | 48.3% | 66.7% |

# Conclusion

- Immersion/inversion is having positive outcomes
  - Year on year improvement in student response
- Students empowered to direct own learning through research
- Students engage with the subject matter
- Students engage with the learning process
- Teachers learn through research about Education