

An engineering design course; developments over five years emphasising topics of sustainability

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Overview

- Background to 2nd year Design module in School of Mechanical and Systems Engineering at Newcastle University
- Five years of developments
- Student feedback - focus on last two year's
- Discussion
- Your questions

2nd year Design module

- School offers 3-year BEng and range of 4-year MEng Mechanical Engineering degrees, all accredited by engineering institutions
- Typically 70 2nd year students, mainly UK (though 94 last year)
- 20-credit module (1/6 of year)
- Runs over two semesters
- One 3-hour 'design' session and two 1-hour 'lectures' per week for two terms

2nd year Design module

Five years of developments (1)

- 2005/06 new module leader introduced changes
- Group projects, lasting over two semesters, pre-assigned groups of 5 students
- Project in conjunction with local engineering company – caravan manufacturer
- Assessed by group presentations (x2), group reports (x2) and individual logbooks (x3)
- Similar project and format 2006/07
- 4 members of staff (including TJ)

2nd year Design module

Five years of developments (2)

- 2007/08 new module leader (TJ)
- Retained group projects, groups of 7
- Greater focus on sustainability
- Assessment 'peaks' reduced, 'weekly updates' introduced, regular formal written feedback given to students during course
- Similar format 2008/09, but access to lab space for manufacture, wind tunnel for testing, and funding for student-selected purchases
- 2008/09 projects, design of wind turbines

2nd year Design module

Learning outcomes

- These are based on UK-SPEC
- 18 aspects were felt to be covered including:
- D4 – use creativity to establish innovative solutions
- P8 – ability to work with technical uncertainty
- S3 – understanding of the requirement for engineering activities to promote sustainable development

2nd year Design module

2008/09 academic year, semester 1

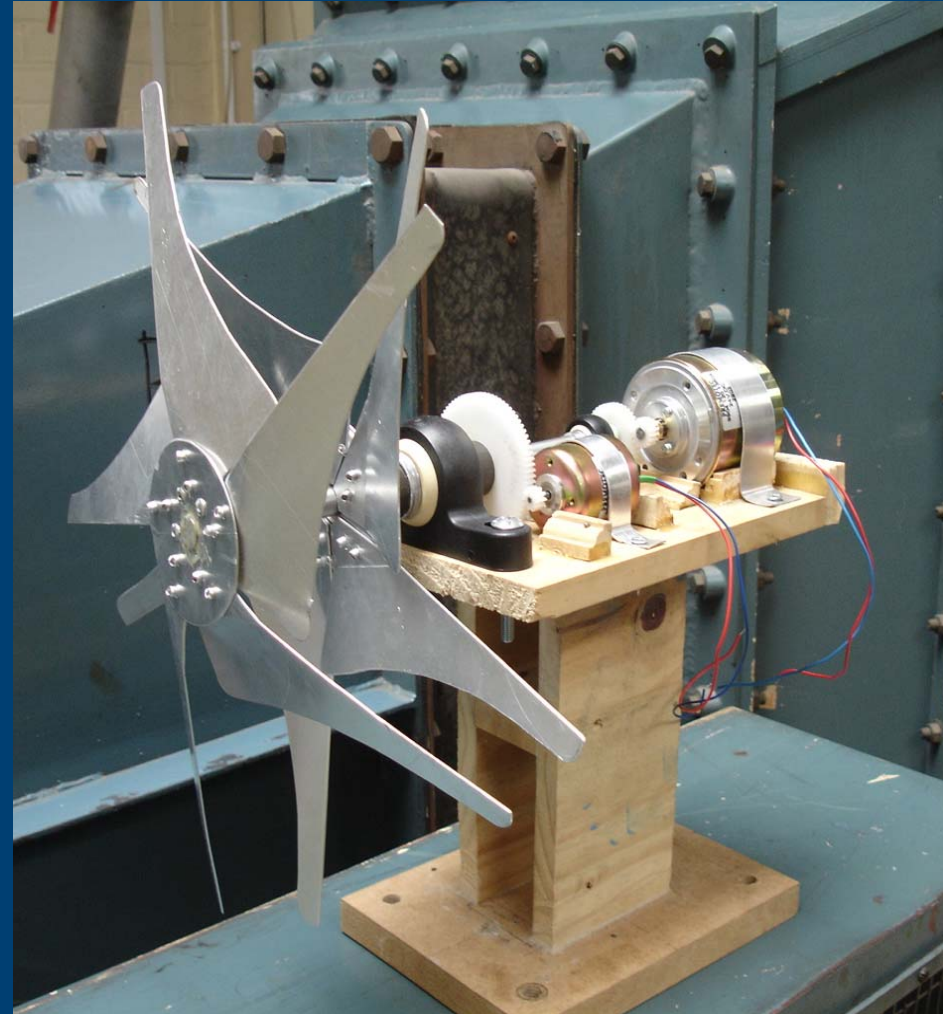


- Each group given redundant computer and printer
- Basic hand and power tools only
- Task to use limited components and materials to design, manufacture and test a wind turbine by end of first term
- Swept area 350mm x 350mm

2nd year Design module

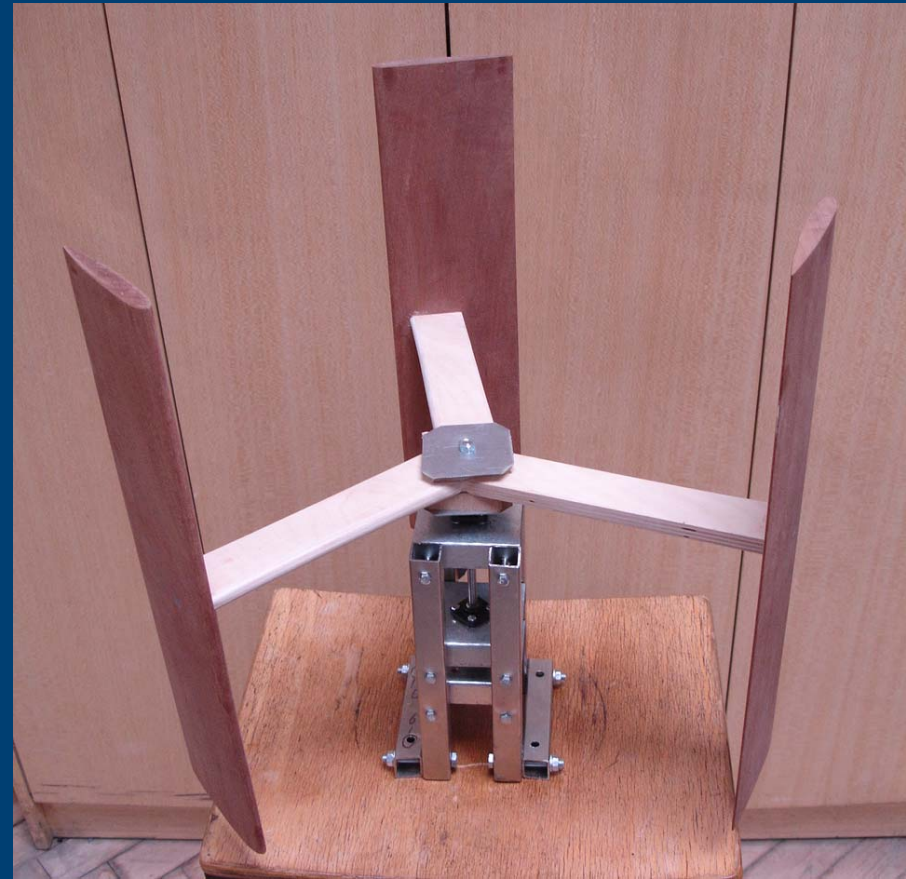
2008/09 academic year, semester 2

- Given budget £100 (€120) – improve your wind turbines (judged on Watt per £)
- Modify or start again?
- Re-design, manufacture and test at end of second term



2nd year Design module 2009/10 academic year

- Similar structure
- Changes based on student feedback and staff assessment:
- Groups based on results of Belbin tests
- Offered a set motor
- 3 weeks to make a basic wind turbine (no motor)
- Rest of time focussed on 'final' design





Sustainability

- Re-use of redundant computer and printer
- 'Renewable' energy generation
- Fossil fuel usage and global warming
- Societal relevance
- Material selection informed by re-use, recycle issues
- Sourcing of components – local suppliers
- Maintenance and design for long-life

2nd year Design module Assessment

- Group essay (5%)
- Seven 'weekly updates' (21% + 5%)
- Group interim report, presentation, testing and assessment of wind turbines (33%) [at end of term 1]
- Group final report, logbooks, assessment and testing of wind turbines (36%) [at end of term 2]
- Groups decide allocation of marks for reports (peer-moderated assessment)

2nd year Design module - paradigms

- Learn by doing
- Learn by regular and balanced feedback
- Creativity encouraged, sense of ownership of learning
- Experience of team work, presentations and report writing
- Budget allows cost issues and communication with companies to be practised
- Complete life cycle from idea, through design, to manufacture and testing

Student feedback, 2nd year Design

Final group reports

Individual logbooks

Individual feedback forms



Comments from final group reports

- *It was refreshing to actually apply engineering knowledge to a real application*
- *A lot was learned from the achievements and failures*
- *a group of young future professional engineers who now have experience in managing long-term engineering projects as part of a team*
- *A lot has been learnt through the duration of the entire project, knowledge which could not have been conveyed from lecturer to student other than through (this) type of practical learning*

Comments from individual logbooks

- *Research played a huge role into finding solutions, and with all this research provided self learning which probably could not have been absorbed if it was taught in lectures etc.*
- *Taking the project into our own hands allowed the team to explore the project in many ways and determine our objectives and achievements. Again this allowed a more advance learning into the project, whereas if it was taught, then the opportunity to 'explore' would not be permitted.*

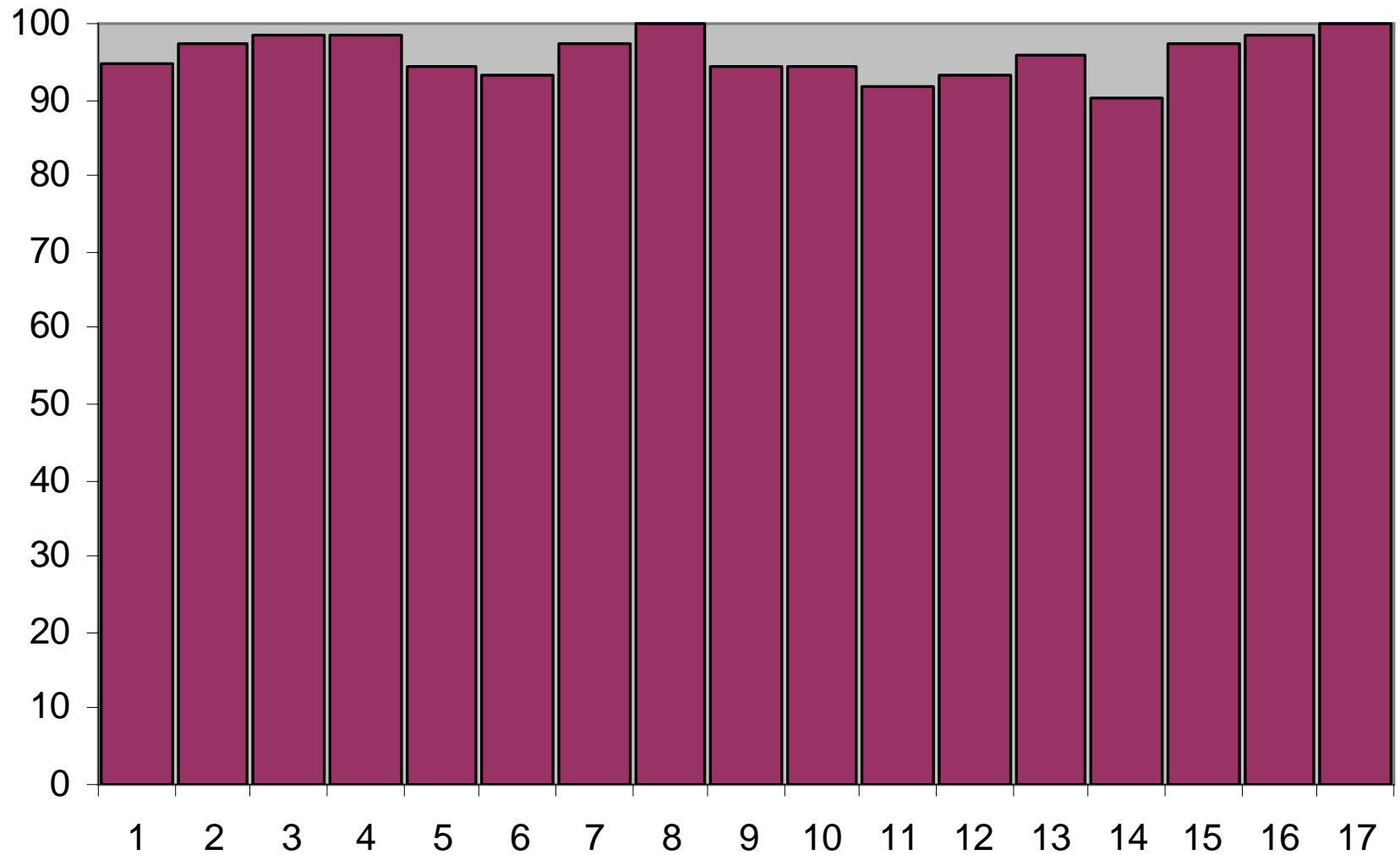
Comments from feedback forms

- Anonymised forms, ten questions answered on a 5-point scale
- Four open-ended questions
- *‘We actually got to do stuff’ ‘Whole process from design concept to testing showed continuity’*
- *‘I feel as though I have learnt more in this module than the entire 1st year’*
- *‘The course gave the feeling that I was working as a real engineer’*

Comments from feedback forms

- *'The course was run in a professional manner and we were treated as such'*
- *'Applying engineering for relevant project (environmental issues)'*
- *'Encouraged imaginative thinking. Good hands on learning. V good module'*
- *'Budgeting and component sourcing from companies. Made new friendships within the group. Very enjoyable, made learning not a chore'*

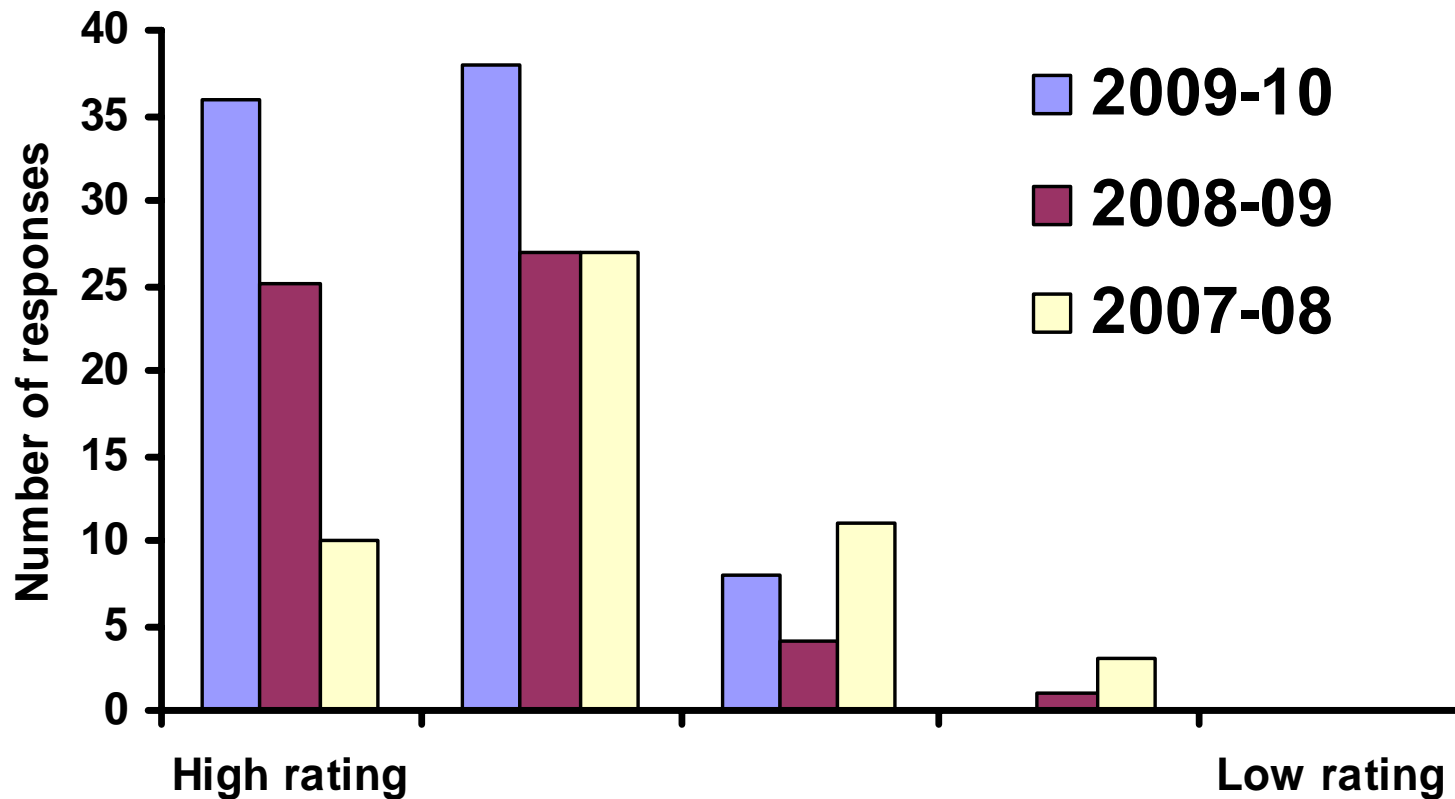
2nd year Design module Attendance rates 2008/09



2nd year Design module

Longitudinal comparison of feedback

Student answers to "Your overall rating of teaching on the module"



Discussion

- Feedback from students and staff involved in module has been overwhelmingly positive
- I believe hands-on experience is crucial
- To take a project from a blank sheet of paper to final testing, with involvement of a budget massively aids the learning experience
- Students rate this highest among all second year modules

Royal Academy of Engineering 2005 'Educating Engineers in Design'

- *And what do we need to teach? We don't. We need to give the opportunity to gain experience and awareness in multi-disciplined team environments and let the confidence of youth loose on a prepared world. What can we give students in a university department?
Experience of working in multidisciplinary teams working on realistic projects.*

ISEE
2010

1st - 2nd JULY

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Thank you

Any
questions?



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