



Queen's University
Belfast



Bridging the Gap – An Active/Interactive Approach to Introductory Aerospace Education

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Overview

- Background to the problem
- Ethos
- Process and Structuring
- Experiences
- Concluding remarks



Background

Many undergraduate students fail to appreciate many of the practical aspects of design due to the focus on disciplinary education in the earlier years.

Additionally, secondary level education does not prepare students for the self guided learning required at university, which can lead to poor student performance.



Background

Aims:

Promote of a partnership in learning in an early stage introductory module

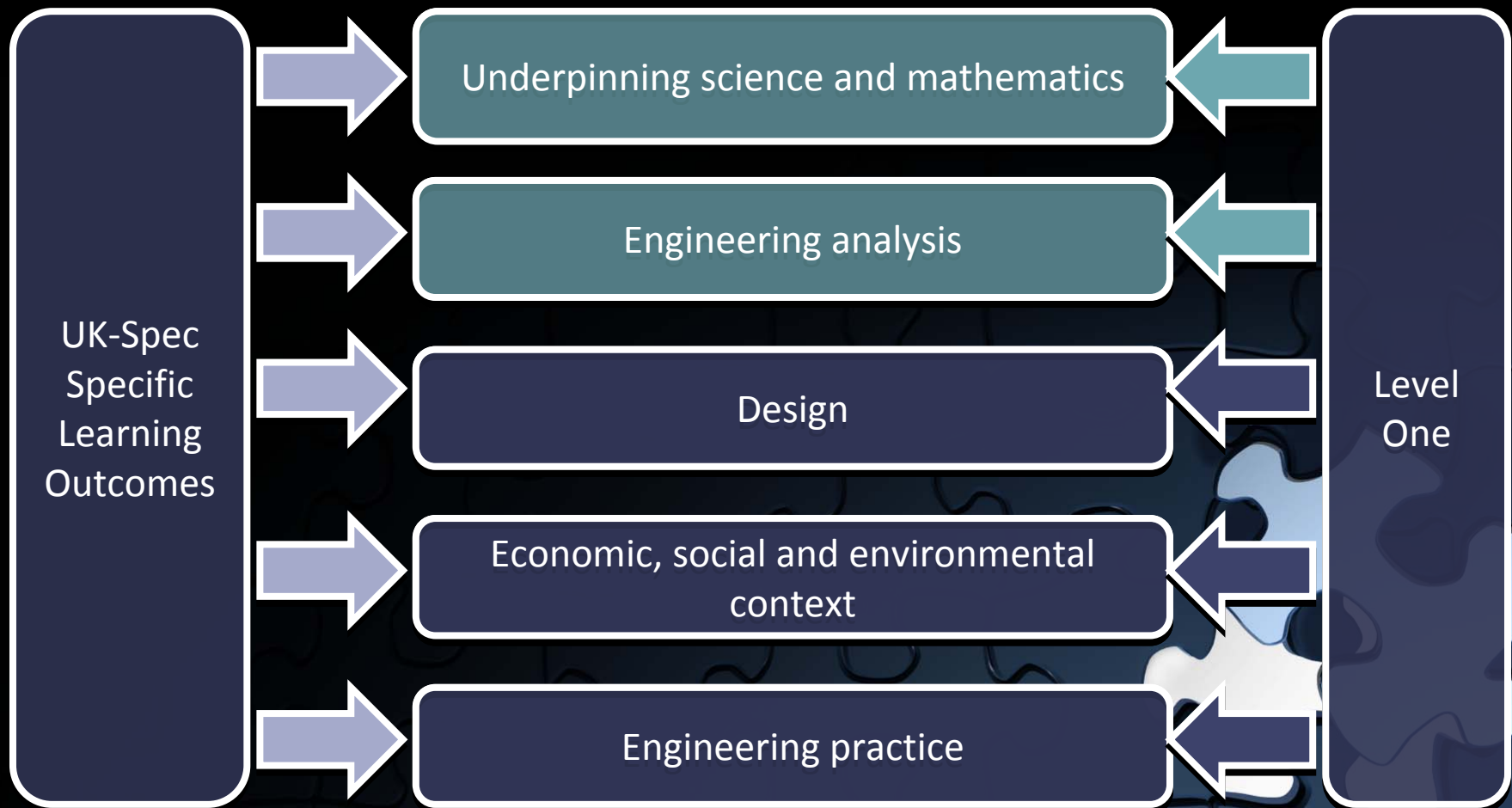
Appreciation of the interdisciplinary nature of design at as early a stage as possible.

Balance of technical rigour with opportunities for practical engagement in subject matter.



Background

UK Spec learning opportunities:



Process

Step 1 : Identify the drivers

Step 2 : Review the Technical Competencies

Step 3 : Develop the Themes

Step 4: Review Aims and Objectives

Step 5: Evaluate against UK SPEC

Will it provide opportunities to interact with the

Does it compliment the five specific learning outcomes identified in UK-SPEC?

Does it encourage them to learn about the full range of technical disciplines?

Background

Student surveys to identify key issues and motivators.

Complimented with a full course review to identify opportunities

These issues became key in developing new course structure....

Ethos

To enthuse and motivate Level 1 students about Aerospace Engineering in an aviation themed environment.

Purely practical design environment

Flight Mechanics

Materials

Electrical Engineering

Engineering Mathematics

Engineering Design

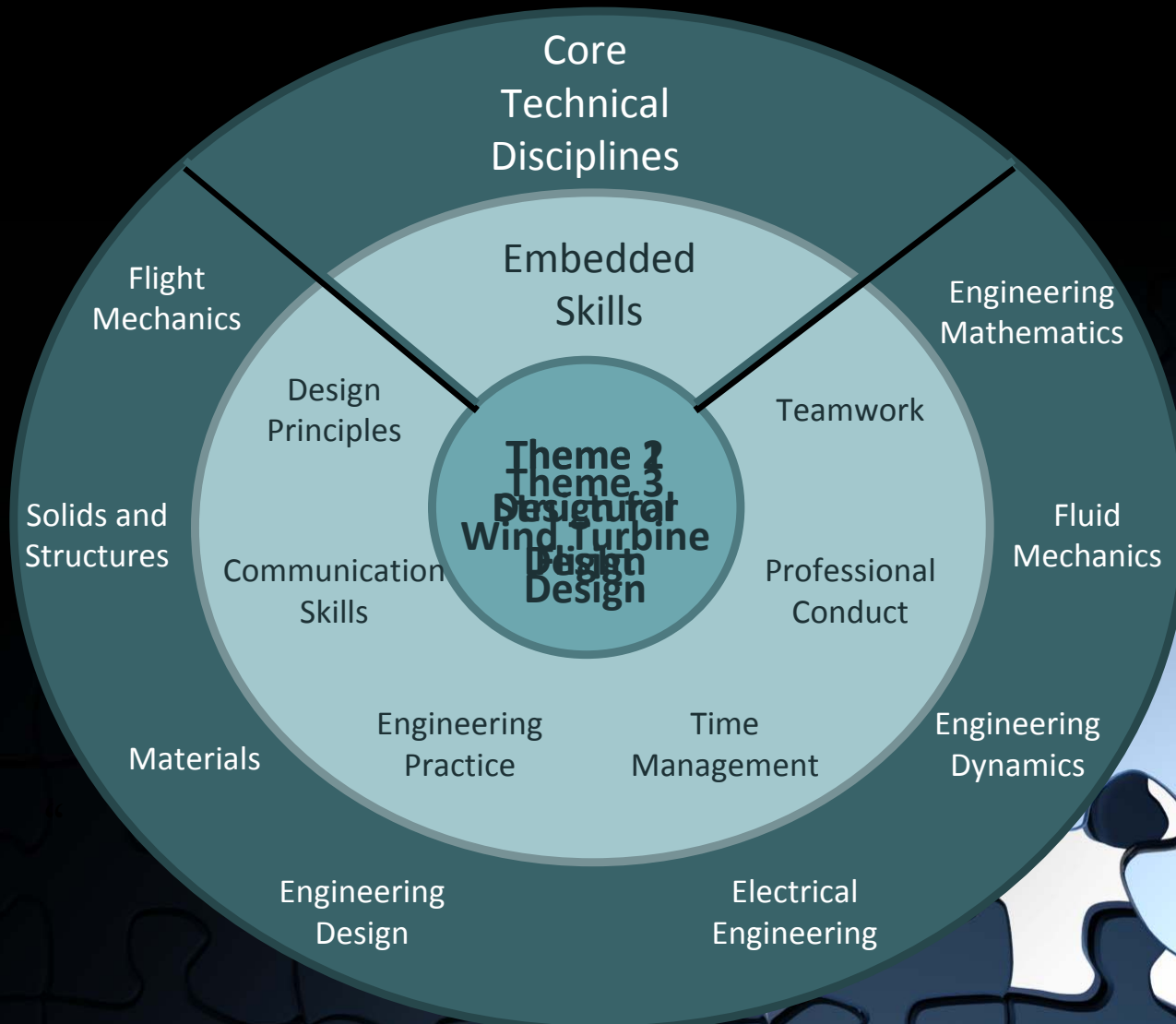
Solids and Structures

Engineering Dynamics

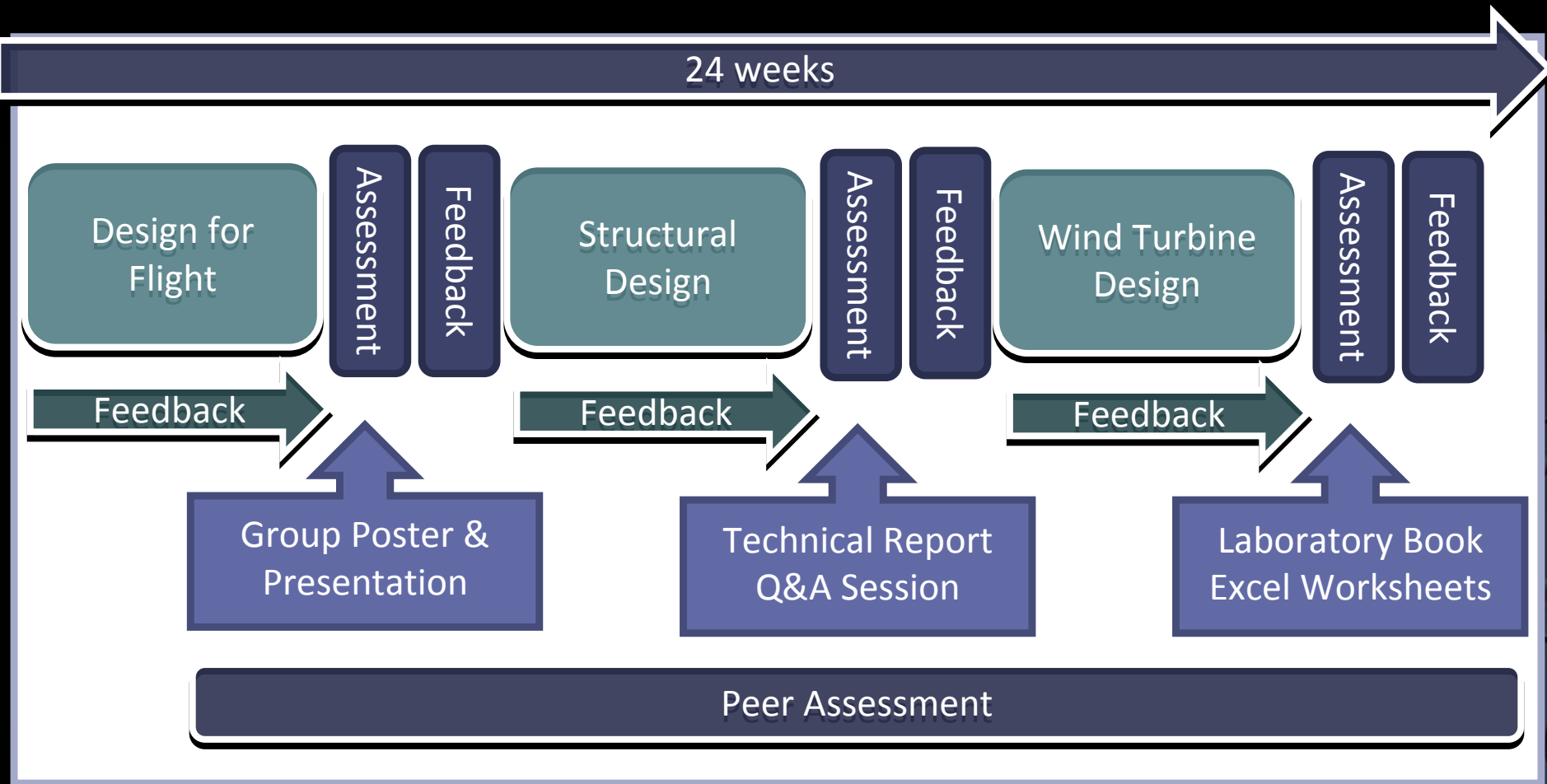
Fluid Mechanics

Professional Skills

Course Evaluation



Structuring



Theme 1: Design for Flight

The consequences of poor design.....

Built around poor design consequences, small groups,
more personal interaction

Introduced basics of aircraft
design, control and flying.

Numerous modifications
to software to simulate off
design conditions.



Theme 2: Structural Design

The iterative nature of design.....

Construction of a wing spar structure using lollipop sticks with basic specification.

Design, build, test, inspect,
redesign, rebuild, retest



Importance of sticking to the specification!

In every instance, second build was
structurally better



Theme 3: Wind Turbine Design

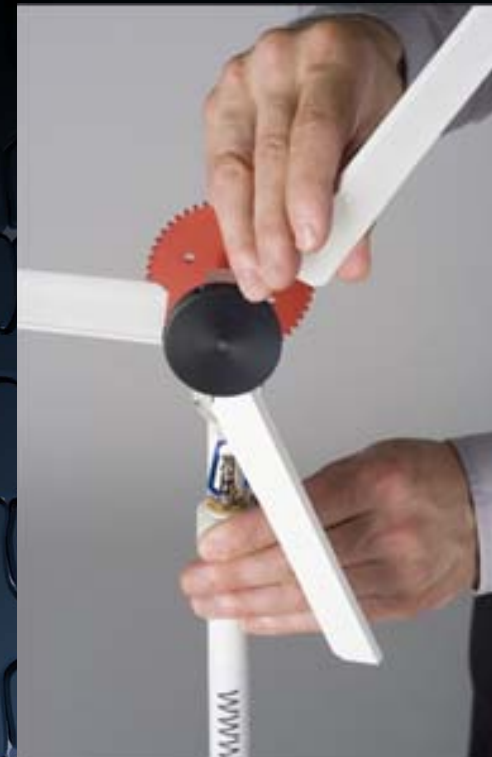
The flexibility of design.....

Sustainability, multidisciplinary nature of design, wider context of engineering

Influence of interacting design parameters on design space.

Emergent behaviour in systems

Importance of validation.



Experiences

Importance of short Introductory exercises

- Student confidence in their own ability outside of the framework of assessment.
- Lecturer-student engagement
- Re-affirm student choice to study Aerospace



Experiences

Thematic progression

- Gradual building of material with explicitly identified links to core material.
- Reduction of formal guidance in how to apply theory to design problems as time passes on and confidence increases.
- Explicitly reward self-study and innovation in coursework.

Experiences

Reflection and Feedback

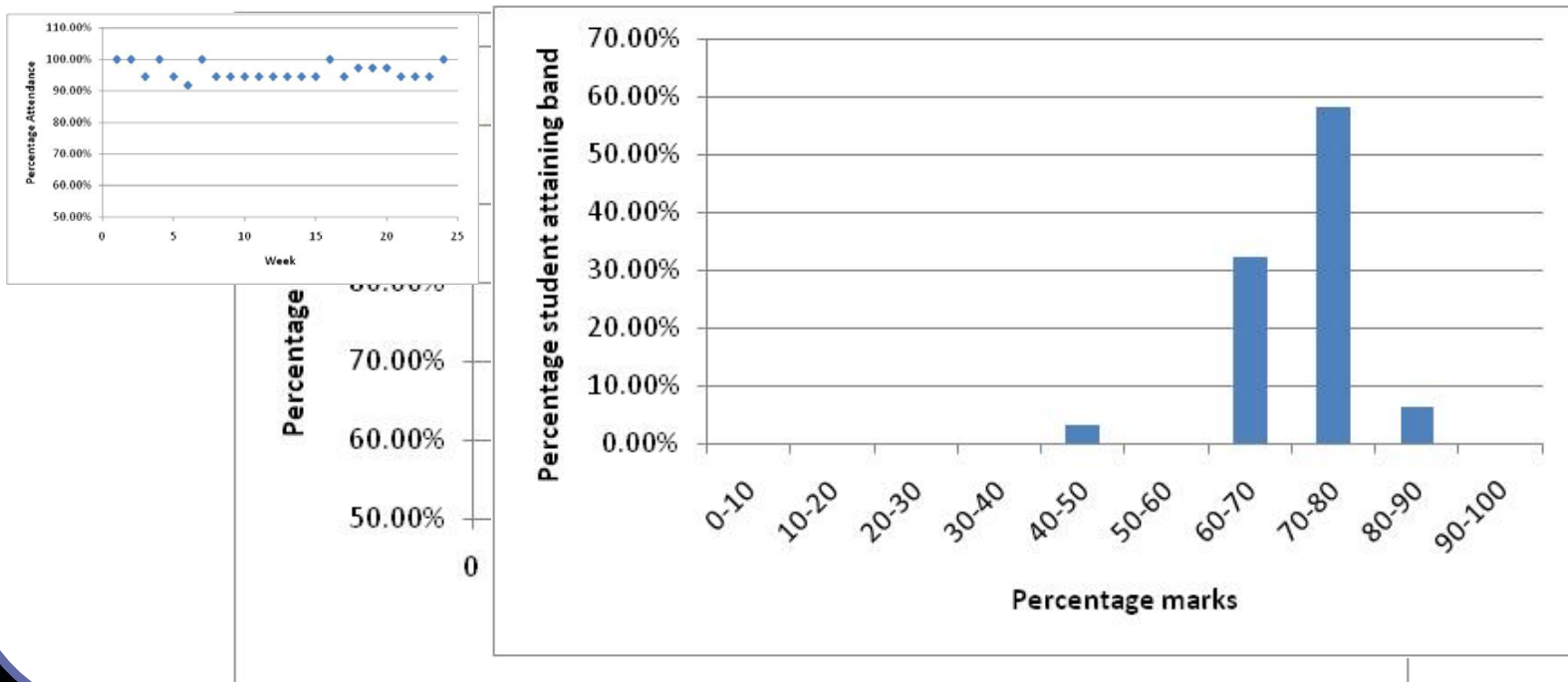
Process of reflective practice on performance is structured to be evolutionary as well:

- Stage 1: Explicit instructor based
- Stage 2: Peer based
- Stage 3: Self based

Experiences

Absenteeism and Motivation

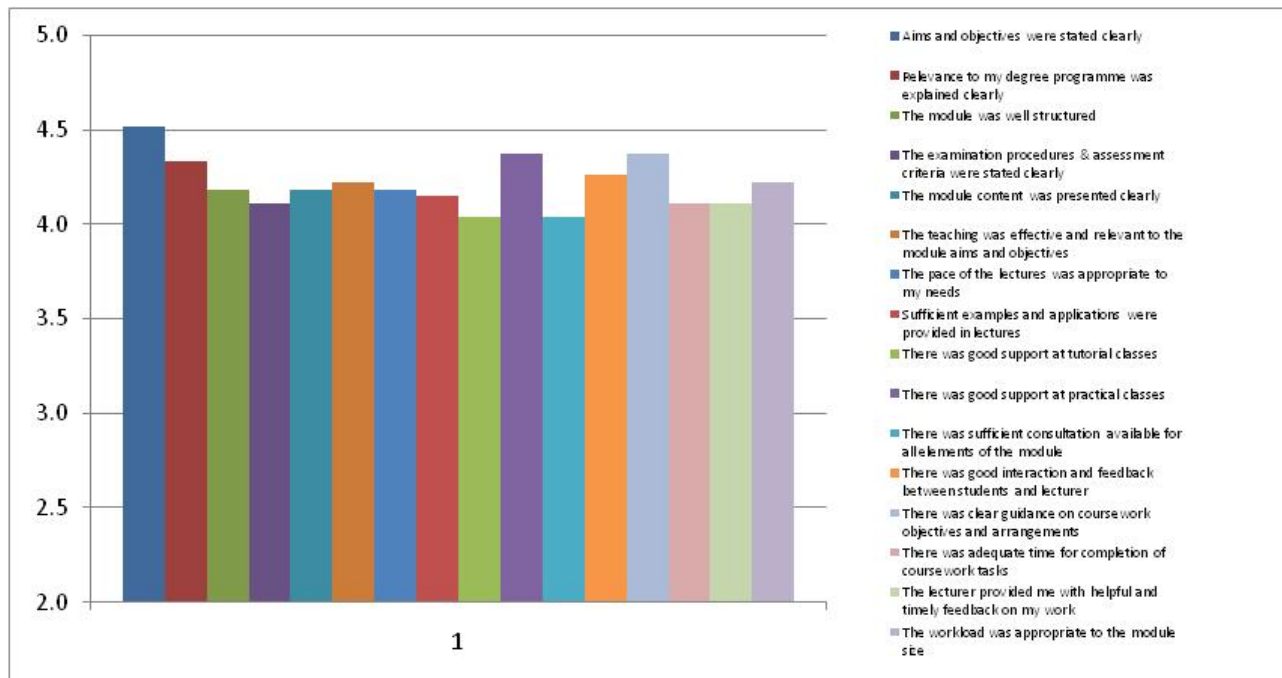
Traditionally, absenteeism in first year groups is high, particularly where self directed learning is required.



Experiences

Absenteeism and Motivation

Feedback from students across all elements of the module was positive.



Experiences

Staff-Student Engagement

Greater awareness of learning barriers encountered by first year students.

Individual student issues much more quickly picked up than might have been otherwise.

Using instructors from mixed disciplines (in this case, structures and aerodynamics) enabled a balanced approach and ensured that no prejudice to one discipline was introduced at an early stage.

Conclusion

The module facilitates experience of the engineering design process and an appreciation of some of the challenges at an early stage.

Lecturers can understand more about the way in which new student engineers assimilate and use engineering information to make judgments in the design process, and how to facilitate improving this in later years.

Outcome – better appreciation from staff about how students learn about design and better engagement of students in the process.



Conclusion

This has provided a valuable opportunity for the staff to learn with the students we will continue to develop the module in response!





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Any questions?