E-Learning Seminar
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Enhancing Design students’ engagement in technology-based subjects:
A practical learning and online assessment strategy

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It has been recognised that there is an issue with the motivation of students in design to engage with the technology aspects of their programmes and incorporate technology to a satisfactory level in their design projects.

A technology-enhanced learning strategy has been developed and applied to address this issue.

This includes:

- Online **formative** and **summative assessment** through myBU
- **Practical learning** (linking theory to practice)
The strategy has been implemented in the Level C Technological Principles Unit:

- Delivered to four programmes across the Design Framework
  - BSc Design Engineering
  - BSc Design Visualisation
  - BSc Product Design
  - BA Product Design

- Approximately 100 students

- Level of maths ability varies from those who have just passed their GCSE to those who have studied A-level maths
The online assessment strategy utilises the virtual learning environment myBU.

A number of formative assessments have been set up within it that combine both multiple choice and calculated answer questions.

Two online summative assessments (75% of unit mark) are run at the end of the Autumn and Spring terms.
myBU allows random variables to be used in the assessments to ensure each student has a different question.

Question 11

An I section beam with section properties \( I_x = 976.82 \times 10^6 \text{mm}^4 \) and \( I_y = 104.95 \times 10^6 \text{mm}^4 \) and cross-section shown below is subjected to a bending moment \( M \) of \( 7.15 \times 10^6 \text{Nmm} \) at a certain point along its length. It is made from aluminium with a modulus of elasticity of \( 73 \text{GPa} \). What is the maximum stress (in MPa) on the section (to 2 dp)?
Students receive instantaneous feedback (score and hints as to how they should have approached answering each question).

Provides the student with valuable information to reflect upon.
Enables tracking of scores and the dates of attempts at each assessment.

Becomes clear which students have not engaged in the formative assessment strategy.
The practical learning strategy is based on linking theory to practice to develop student knowledge by learning through enquiry.

Self-contained experiment workstations with hardware and online support for completing the experiments and storing the data through myBU have been developed.

Each experiment has been instrumented to capture key data from it (e.g. strain and displacement) through a bespoke computer application.
Students are provided with an interactive laboratory handout, which takes them through the experimental procedure and allows them to study the effect on the rig/component due to the application of load.

Students are required to validate these results using the theory they have covered in lectures.

The handouts have been generated to allow the students to explore the effect of changing parameters on the results therefore allowing them to learn through enquiry.

These developments aim to further motivate students to learn independently.

This has been achieved in collaboration with David Fevyer, Learning Technologist.
myBU interactive handouts has:

- procedure video clips
- interactive laboratory sheets
- self assessment exercise
- links to relevant analysis tools
PRACTICAL LEARNING STRATEGY

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- interactive laboratory sheets
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<table>
<thead>
<tr>
<th>LOAD</th>
<th>DEFORMATION (mm)</th>
<th>LATERAL STRAIN (MICRO)</th>
<th>LONG STRAIN (MICRO)</th>
<th>POISSONS RATIO</th>
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</tr>
<tr>
<td>50</td>
<td>490.5</td>
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</table>

Table 1: Experimental aluminium deformation and strain results.

**Conclusion**

How did the results of the experimental property results compare with the known properties of the materials (Tables 5 and 6)? What conclusions can be drawn from the different Young’s Moduli and Poisson’s ratios for the different materials (Tables 5 and 6)?

The results show...
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MDSolids can confirm the results obtained by hand calculations and can be used to track down errors in the hand calculations.

In this instance MDSolids simulation results are used to further reinforce the accuracy of the experimental and hand calculation results.
Once confidence is gained in the use of MDSolids it is also encouraged to be used in the revision process if the student is struggling to answer revision questions.

MDSolids also has a number of animated learning tools and games, which provides further revision, and learning support material.
A questionnaire was given to all students enrolled on the unit through myBU to gather feedback on the strategies.

The questionnaire consisted of eight questions.

The responses were submitted anonymously.
100% of respondents “agreed” or “strongly agreed” that the laboratory sessions were beneficial in their study of mechanics and statics.

96% of respondents “agreed” or “strongly agreed” that they would have benefited from laboratory sessions in the other topics studied in the unit (fluids, thermodynamics, etc.)

100% of respondents “agreed” or “strongly agreed” that the online worksheets were beneficial in developing their understanding of the concepts they covered.

36% of respondents felt the online tests were most beneficial in helping them understand the concepts covered.

36% of respondents felt the ability to revisit worksheets at a later date was most beneficial in helping them understand the concepts covered.
96% of respondents “agreed” or “strongly agreed” that the practice online assessments aided their revision.

76% of respondents “agreed” or “strongly agreed” that they prefer online assessment to traditional paper-based assessments.

88% of respondents “agreed” or “strongly agreed” that the online assessment and practical learning strategy has helped them engage with the technology aspects of the course.

Other comments included:

“Very interesting, hope it continues into more detail, and more topics in year 2.”

“Keep the worksheet and online test, its the easiest way to revise.”
The strategy allows confidence to be gained in the theory they learn, learning through enquiry, regular assessment, instantaneous feedback and indicates progression and/or understanding of each topic.

A marked increase in performance (approximately 10% improvement in average mark) was seen with the introduced strategy.

In previous years an extra support session has been required to support the weaker students. This has not been required under this strategy.

Student satisfaction in the unit has increased.

The new strategy reduces contact hours (contact hours have reduced from 14 hours a week to 6 hours a week)
A large amount of initial effort is required to set up assessments and labs over the summer.

A database of questions is being generated to make generating assessments quick and simple.

However, the marking burden has substantially reduced and there are less resits to mark.