

# Mathematics in STEM - transition issues

Improving students' mathematical transition  
from A levels to STEM degree courses

Charlie Stripp, MEI Chief Executive

# Increased uptake of A level Maths and Further Maths

*‘The increase in the take-up of A-level mathematics and further mathematics has been dramatic.’*

Mathematics: made to measure, *Ofsted, May 2012*

# University offers

- Fluency and confidence with maths is a vital element in students making a smooth transition from school/college to university in STEM subjects
- Prospective undergraduates in Engineering and Physics should be made aware of the importance of mathematics on these degree courses
- University departments should require A level Maths their offers and encourage or require AS/A level Further Maths
- This would help drive continued increases in uptake

## **Aberystwyth University**

**Physics:** *'We strongly support the idea of encouraging students to choose Further Maths for their A level studies and schools to offer this option to their pupils.'*

*Our students who had A level Further Maths coped with the transition from school to university much better than those who had only standard A-level Maths. It is our policy, when other factors are equal, to prefer candidates holding qualification in A level Further Maths over candidates holding A level Maths at the same grade.'*

## Swansea University

**Engineering:** *‘The College of Engineering at Swansea University is pleased to support the Further Mathematics Support Programme Wales.*

*Further Mathematics is not a requirement. However, we encourage prospective students to take Further Mathematics, either at AS or A level. The College is prepared to be more flexible with students who have studied Further Mathematics but have not met the standard offer.’*

# Mechanics modules

*'The topics taught within a subject at A level did not always coincide with the knowledge requirements of higher education. For example, Engineering first year undergraduates with A level mathematics qualifications did not always study Mechanics at A level. This led to a greater variety of knowledge among first year students and also gaps in their knowledge.'*

Fit for Purpose? The view of the higher education sector, teachers and employers on the suitability of A levels

Ipsos Mori Social Research Institute, April 2012

# Mechanics modules

- The 2008 report, *Newton's Mechanics: Who Needs It?*, highlighted the advantage to Physics and Engineering students of having studied mechanics modules within A level Maths
- Studying mechanics helps develop students' modelling and problem solving skills
- University prospectuses and offers could encourage students to take mechanics modules
- Taking Further Maths gives students more opportunity to take mechanics modules

# The Extended Project Qualification (EPQ)

- Introduced in 2009, ~5000 candidates; in 2011 there were ~25 000 candidates
- Equivalent to half an A level
- Students research a topic of their choice, produce a report and make a presentation of their findings
- Can be an excellent vehicle for students to develop/demonstrate modelling and problem solving skills
- Universities could encourage prospective students to undertake EPQs involving mathematical modelling and problem solving



# Outreach

- Outreach can help get across the message of the importance of maths in physics and engineering
- MEI is working with an HE STEM project on mathematical modelling and problem solving, to provide outreach at the universities of Keele, Leeds, Manchester and the West of England
- The FMSP works with universities across England to support outreach work related to mathematics

# Curriculum development

*"I do not envisage the Department for Education having a role in the development of A-level qualifications. It is more important that universities are satisfied that A-levels enable young people to start their undergraduate degrees having gained the right knowledge and skills, than that ministers are able to influence content or methods of assessment."*

Michael Gove, April 2012

# Curriculum development

- Opportunity to improve the mathematics students learn pre-university, to improve transition to Physics and Engineering
- How can we tackle ‘teaching to the test’?
- MEI, as an influential curriculum development body, is keen to engage with universities to inform its work
- The examination awarding bodies are also keen to consult with universities
- A level Maths and Further Maths serve many disciplines in HE and it is vital that representatives of different subjects engage

# Support for new undergraduates

## HE STEM pilot project - Wales

- MEI worked with the universities of Cardiff, Glamorgan and Swansea to develop tailored online materials for new undergraduates
- Resources were made available to engineering and mathematics students from the end of August
- Students were able to reinforce their technical fluency with important A level Mathematics topics before they started at university and during their first term

# Support for new undergraduates

## HE STEM pilot project - Wales

Feedback from students on the pilot project:

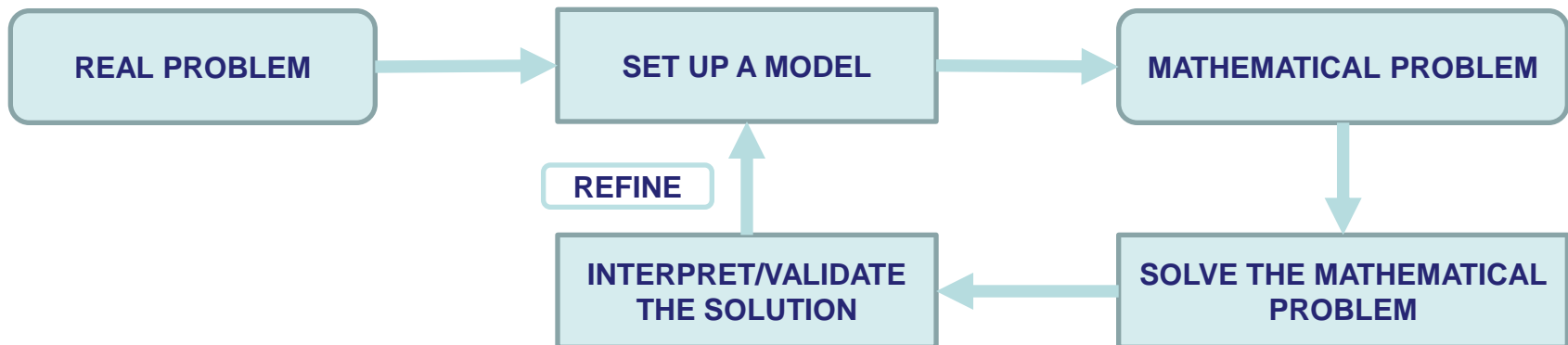
- *‘Having not done any Maths since the summer examinations, the website allowed me to read over concepts and test myself, which refreshed my memory.’*
- *‘It helped to reinforce A level material which I am now using as building blocks for the material I am studying in lectures.’*

A full report on the pilot will be published later this year.

# Support for new undergraduates

## HE STEM project in Mathematical Modelling and Problem Solving:

Leeds University has developed a module for 1<sup>st</sup> year physicists using a mathematical modelling cycle



# Support for new undergraduates

## **HE STEM project in Mathematical Modelling and Problem Solving:**

- The students had to use the ‘Modelling Cycle’ to investigate the motion of cars/bikes on either (i) banked, horizontal tracks or (ii) tracks with vertical circles, refining their models
- Students wrote a final report, following the stages of the cycle
- The students were positive about the course and the physics department is pleased with the results

# Conclusions

- *Be clear about the importance of mathematics in degree level study of Engineering and Physics in prospectuses and offers*
- *Engage with pre-university mathematics education through outreach and involvement with A level curriculum development*
- *Emphasise the importance of maths to first year students and provide tailored support*