**Mathematical Skills in the Transition from School into Higher Education, 8th July 2016**

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**Reasons for concerns** expressed by research councils (eg [*http://www.bbsrc.ac.uk/news/planning/strategy/theme-one/*](http://www.bbsrc.ac.uk/news/planning/strategy/theme-one/)) and ABPI (*Bridging the skills gap in the biopharmaceutical industry: Maintaining the UK’s leading position in life sciences, November 2015.* [*http://www.abpi.org.uk/our-work/library/industry/Documents/Skills\_Gap\_Industry.pdf*](http://www.abpi.org.uk/our-work/library/industry/Documents/Skills_Gap_Industry.pdf) *)*

**Similar problems in USA** (eg Vision and Change Report 2011 [*http://visionandchange.org/finalreport/*](http://visionandchange.org/finalreport/)) **and Australia** (eg <http://www.qsinscience.com.au/>).

There is a **mismatch in the curriculum** between schools and university and, at times, unrealistic expectations from university teachers. Maths backgrounds vary enormously from C at GCSE through to A at A level maths with therefore a large variation in what students might be able to do. Transferring knowledge or understanding from maths into science is a higher order skill and most secondary students need to have the maths re-taught in science lessons.

The MEI publication “Understanding the UK Mathematics Curriculum Pre-Higher Education A Guide for Academic Members of Staff 2016 Edition” is a really useful guide for HE <http://www.mei.org.uk/files/pdf/pre-university-maths-guide-2016.pdf>.

The Association for Science Education have recently published a really useful guide aimed at secondary school teachers but I think it will also prove to be very useful in HE and FE. It’s called the “Language of Mathematics in Science” available from  <http://www.ase.org.uk/resources/maths-in-science/> It explains the different language used by maths teachers and science teachers in schools.

Three key issues from observations of maths in secondary science:

1. Reliance on procedural learning driven by predictable, low cognitive demand assessment questions – eg use of formula triangles.
2. Lack of fluency and ability to visualise how maths relates to science – eg deciding how much larger or smaller an object is when the size is given in standard form rather than as an integer, especially when the powers are negative.
3. Missing connections between threshold concepts and topics that rely upon them – in A level biology the statistical tests are required but the underlying concepts of ordinal/categorical vs ratio/interval are not explicitly stated.

**Affective Domain**  - maths anxiety, lack of confidence, “maths content of a bioscience degree comes as a shock”… survey of first year university lecturers in maths for biology. Koenig (2011), <https://biomathed.files.wordpress.com/2016/01/biomaths_landscape.pdf>

**Solutions:**

Biomaths Education Network – sharing ideas - <https://biomathed.wordpress.com/>

Sigma Network –- [**www.mathcentre.ac.uk**](http://www.mathcentre.ac.uk/) – website with resources contributed by the community

Revolution in approach to maths teaching – Jo Boaler “Elephant in the Classroom” <https://www.youcubed.org/the-elephant-in-the-classroom/> and other resources on the youcubed website.

There is more problem-solving in the new maths specifications and ACME have written an interesting document that addresses some of the difficulties in assessment of problem solving. <http://www.acme-uk.org/media/35168/acme%20assessment%20of%20problem%20solving%20report%20-%20june%202016%20-%20final.pdf>

The Royal Statistical Society and ACME have produced a report “Embedding Statistics at A level: a report on statistical requirements and assessment across A level courses in Biology, Business, Chemistry, Geography, Psychology and Sociology”  <http://www.rss.org.uk/Images/PDF/publications/rss-ACME-embedding-statistics.pdf>