# Over the Threshold

how schools, colleges and universities can work together to build mathematical foundations for successful progression

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CETL-MSOR 2019
Bringing Together Mathematics Communities
5 September 2019

# Introdcution

I will mostly be talking about what has become known as 'Widening Participation'

Thoughts based on work over 50 years in the English system, teaching in secondary schools and universities

Largely in the Mathematics Department of KIng's College London

What do I mean by 'threshold'?

Schools, Colleges and HE must work together

# Outline

1. Widening Participation
2. Mathematics in Widening Participation
3. One particular project
4. Sample material
5. Beneficial side effects
6. Some issues

Reasons include:

- Social justice
- Not wasting talent

Generic approach, raising aspirations:

- Bursaries
- Lowering entry standards
- Support after admission

'Getting in' is not enough

Essential that students accepted onto a course feel they belong, and can thrive and succeed

Co-operation between stages essential to ensure this for students

Why single out Mathematics?

- Mathematics underpins almost every subject
- Perceived failure can put brakes on
- Outcomes may be poorly assessed
- Aims may be restricted to next test

## Need approach to Mathematics that:

- enables students to tackle hard problems and relish a struggle
- makes students relaxed about trying out ideas, even though some will fail
- encourages students to sketch grahps and diagrams
- encourages students to talk about maths and work together

After school club for A-level Maths students in years 12 and 13 at targeted schools, voluntary attendance, only entrance requirement being wanting to do more maths

Aims include

providing an ambience which allows mathematical understanding and enjoyment to develop

helping students reach normal rather than lowered entry standards

helping students learn in a way which transfers to success at later stages

# One particular project
## continued

Sessions are informal,

working in groups around tables in room with with whiteboard walls

sessions led by lecturers, backed up by undergraduate tutors

food is provided!

[2004 STEP I question 1]

1. Express $(3+2\sqrt{5})^3$ in the form $(a+b\sqrt{5})$ where $a$ and $b$ are integers.
2. Find the positive integers $c$ and $d$ such that $\sqrt[3]{99-70\sqrt{2}} = c - d\sqrt{2}$.
3. Find the two real solutions of $x^6 - 198x^3 + 1 = 0$.

[2009 STEP III question 6]

Show that

$$|e^{i\beta} - e^{i\alpha}| = 2\sin\frac{1}{2}(\beta - \alpha)$$

for $0 < \alpha < \beta < 2\pi$ . Hence show that

$$\begin{aligned} |e^{i\alpha} - e^{i\beta}||e^{i\gamma} - e^{i\delta}| \ + \ |e^{i\beta} - e^{i\gamma}||e^{i\alpha} - e^{i\delta}| \\ = \quad |e^{i\alpha} - e^{i\gamma}||e^{i\beta} - e^{i\delta}| \end{aligned}$$

where $0 < \alpha < \beta < \gamma < \delta < 2\pi$.

Interpret this result as a theorem about cyclic quadrilaterals.

# 5 Beneficial side effects

As well as direct benefits to the students who come to the Kings factor:

The lecturers who help learn where their undergraduates are coming from, which strengthens post-entry support

The mathematics of the undergraduates who help is strengthened, and their confidence raised

Students can meet others from a variety of different schools

Students can see that they are not alone in being keen on maths

# 6 Some issues

Within some HE institutions, reward and recognition of work with school students is not always as high as it should be.

Universities are measured by their own entry profiles. To encourage cooperation, need mechanism to recognise when one university has enabled progression to another.

Fragmentation of school system in England makes systematically building links with local schools harder.

# And also ...

Many other things I could have talked about, including:

UAS

Supporting teachers

Specialist maths sixth form colleges