Maths In Europe

maths.dur.ac.uk/MiE/

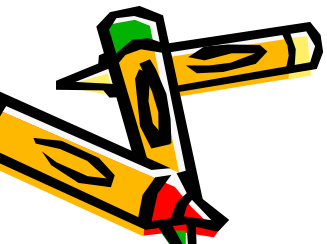
Talks:

- Overview & Context
- Catherine Isaacs (SCA – community.action@durham.ac.uk)
- Iain MacPhee (Admissions – I.M.MacPhee@durham.ac.uk)
- James Blowey (J.F.Blowey@durham.ac.uk)
  - Mathematics Teaching MATH3121
  - Durham's VLE - what do users think of it?
  - Symbolic computation in the curriculum.
  - Pan european test

European Contract 2002-5569/001-001 SO2 61OBGE - Grant request 38/2002
"Diffusion and improvement of mathematical knowledge in Europe"
Socrates Program - Action 6.1

Overview & Context

- Time of change
- Smith Report – probably all aware. LMS report:
  - National policy must have a coherent approach at all levels.
  - Young people must be encouraged by well-trained teachers.
  - Vice-Chancellors are closing down some Maths Departments

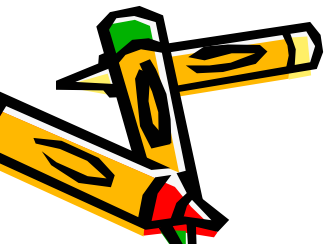


International Review of UK Research

- ***1.4. Training Mathematicians at UK Universities***
  - *Undergraduate enrolments in mathematics are stable or just begin to show signs of decline, in contrast to those in some European countries. However, the Committee noted well-founded concerns with a decline in the quality of the mathematical training of incoming students and the number of teachers at the school level who do not have the appropriate level of mathematical qualifications. The former derives from the latter, at least in part, and new efforts are needed to reinstil a love of mathematics and the teaching of mathematics amongst school teachers. This is not, however, a peculiarly UK problem.*
- ***1.5. Public Appreciation of Mathematics***
  - *Efforts are being made to raise the public awareness of mathematics but it is our perception that there does not exist widespread appreciation in society at large of the impact that mathematical research has made on the modern economy. It has never been easy to communicate mathematics to the broad public, com pared to other scientific disciplines such as astronomy, biology or even physics. Nevertheless, it has become increasingly important that this be done, not only to be able to attract the best young talent into the field, but also to maintain the continuity of the funding necessary for the long-term health of the subject.*

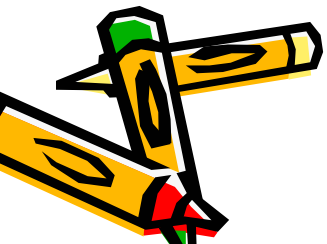
Maths in Europe project: Objectives

- To interest more young people in Mathematics and related fields;
- To compare national experiences and different starting backgrounds with the scope of:
  - facilitating the passage of students from secondary school to university in the areas of Mathematics, Science and Engineering;
  - testing Mathematics, Science and Engineering students at all universities to obtain experience of their entrance level of mathematical skills and so to promote the exchange of European students from different countries



Durham Maths Outreach

- Masterclasses (Dr de Jeu),
- HE Summer School (Professor Dorey),
- SEM (Dr Borgan),
- National Academy for Gifted and Talented Youth (Dr de Jeu & Dr Hoffmann),
- Teachers on Track (Dr Blowey & Dr MacPhee),
- Mathematics Teaching (Dr Blowey),
- Ogden Teaching Trust Fellow (Mark Colman)
- Open Days (various).



National Expertise

- Science and Engineering Ambassadors (SEA) programme: This aims to promote STEM (science, technology, engineering & mathematics). It does this by providing enthusiastic, vetted volunteers to work with young people and teachers in schools who want to inspire and excite children and young people about the possibilities these subjects and the related careers they can offer. For more details visit www.setnet.org.uk/
- Undergraduate Ambassadors www.uas.ac.uk/
- Student Community Action at Universities
  - York www.yusu.org/ysca/
  - Newcastle www.ncl.ac.uk/sis/
  - Durham www.dur.ac.uk/community.action/)

Durham University Student Community Action

Who are we?

- Durham University Volunteers
- Student led

A Brief History

- 13 years old
- Founded by students and staff
- Expanded massively in past 4 year

The Volunteers

- 1220 people on our mailing list
- Approximately 500 active, regular volunteers
- Run different projects:
  - Different commitment length from one off to every week

One-to-one tutoring

- Commitment for every week of term
- Monday – Thursday
- Every week of term
- Elvet Riverside 2
- 7pm-8pm

One-to-one extra

- Tutoring for children with emotional, behavioural or learning difficulties
- Same time, same days, different room!

The Tutees

- Regular contact with one volunteer
- Extra exam or subject support can be arranged
- Authorised certificate of attendance

Volunteer training

- Basic SCA Training
  - SCA intro and guidelines, health and safety, child protection
- Tutoring Training
- Working with children with emotional, behavioural or learning difficulties

Other School Projects

- Homework clubs
- Classroom Assistants
- Exam Revision

Student Community ACTION!

Maths Admissions at Durham

700+ Single Hons applicns come to Maths, a similar no. for Maths + X go to Natural Sciences.

All forms are read (3 of us share the job) and we decide on offers as follows:

the Univ allows us to make ≈570 offers;

our std cond'l offer is A(Maths) + AB;

we don't insist on Further Maths A2 but are thinking of requiring FMaths AS;

most applicants with AAA+ predictions get offers pretty quickly, those below our std offer are mostly rejected immediately, we try to order those with A(Maths)AB and process them later.

Our intake: more than half have AAA+, about 2/3 have FMaths A2, less than 10% do not have FMaths AS.

Some Maths entertainment!

Consider a dynamical system on an equilateral triangle A^0 with vertices e_1, e_2 and e_3.

Position $z(n)$ at time n is a point of A^0 with $z(n+1) = \varphi\Big(z(n)\Big)$ determined by six parameters:

three focal points f_1, f_2, f_3 making an equilateral triangle with A^0 inside it and edge $f_i f_j$ parallel to $e_i e_j$;

a decision point d_i on each edge of A^0;

$z(n+1)$ is the point of A^0 on the straight line from $z(n)$ to f_i where e_i is the *local* vertex of $z(n)$.

Do all trajectories converge onto orbits?

Some key ideas:

continuity except at the d_i

contraction

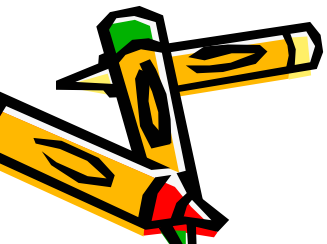
$A^n = \varphi(A^{n-1}) = \cdots = \varphi^{(n)}(A^0)$

pre-images

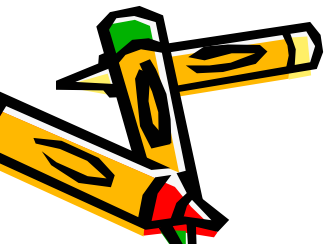
permutations

Maths specific information

- Mathematical Sciences (maths.dur.ac.uk)
- >1000 Students, >50 modules, 35 staff.
- Large range of modules.
- Student monitoring through PSQL database with a python and Tcl/Tk interface to collect student data –written by Peter Craig and maintained by Sharry Borgan –databases back six year.
- Key for student monitoring & Cont. Asses.



Mathematics Teaching MATH3121



A third year module for student taking at least 50% mathematics.

Theme: "Elementary Mathematics from an advanced standpoint"

Assessment: 50% Coursework; 50% Exam.

- **School File** – 15%; due start of Epiphany

  Based on student preference groups are set up to visit one secondary school (Belmont(2), Durham High School for Girls(2), Durham School(4), Durham Johnston(4), Framwellgate Moor(4), Houghton Kepier(2), Oxclose –Washington(2), Royal Grammar School – Newcastle(2), St Leonards(4), Woodham –Newton Aycliffe(2).)

  Observe at least 5 lessons at different years and levels.

  Focus on the class learning experience.

  Student-led themed group seminars reflect on visits

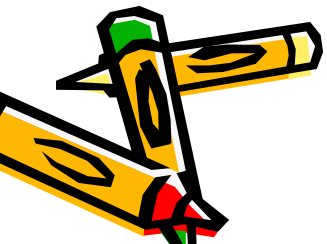
- **Essay** – 30%; due start of Easter; Agree title with JFB before the end of Michaelmas. Topics extremely rich and varied. "Ideal Essay".

Presentation – 5%; throughout Epiphany. 20 minutes duration.

Lectures – (38=1+4+16+17), guest lecture, school seminars, student presentations, others on Problem Solving, Number, Algebra, Geometry, Proof, etc.)

Key skills – arguably not in your average mathematics module and/or valued by employers

- Team work.
- Presentations: group and individual.
- Essay writing.
- Development of critical skills.
- Reflects on students' mathematical experience.



What is Blackboard?

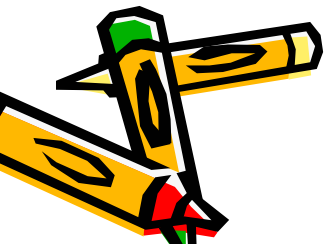
- Web-based virtual learning environment providing course management (documents, assignments, solutions), communication tools (announcements, e-mail), assessment features (surveys, quizzes – MC & MR Q's) and digital dropbox. For example MATH3121 – see next slide
- Communication: discussion boards, groups and chat.
- Other VLE examples: WebCT & Moodle (free).

For example – MATH3121

- Assessment criteria for each component.
- Links to generic schools information on KS's, etc.
- School details: Contact/Performance/League Tables.
- Discussion board used for: school groups; follow-up to seminars.
- Searchable database for: school files; essays.
- Appetisers: hopefully convey excitement of Mathematics & topical stuff

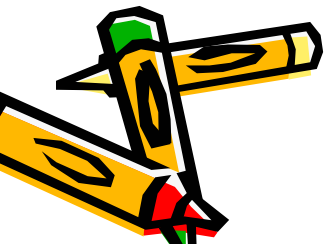
Is DUO a useful resource for staff or students?

- Generalisation of 8/32 atypical Maths staff:
  - An hour or so per week per module on maintainance/ developing/ communicating/ e-moderating.
  - Don't use survey's or quizzes.
  - Do use e-mail & discussion boards.
  - Supports paper based materials.
  - Moderate scepticism and 25% think it is an ineffective learning resource (compares with 15% of students).

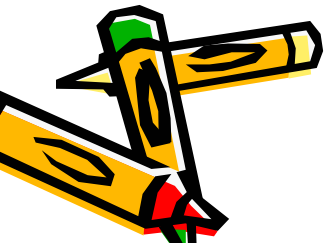


147 students mainly first & second year students

- Majority log on at least once per week for an hour or so, even logging on outside classroom hours.
- Has enhanced learning experience in lectures and helps organised student learning materials.
- Students like combination of paper and electronic material.
- Enhances collaboration.
- Students would like to be able to browse other modules.

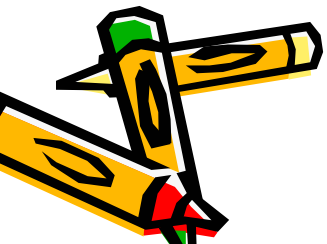


- Generalisation of Maths students:
  - Globally not well used by Maths staff which leads to lack of uniformity.
  - Many prefer the layout of the Maths Department website – generic information complemented by individual websites.
  - Appreciate that Discussion Boards are potentially useful.



VLE's not ideal as assessment

- Mathematics oriented tools:
  - CALM, i-Assess, QuestionMark (-ve's: A-level mathematics/non-symbolic/randoms/graphs).
- Integrate php, SQL database and Maple (symbolic calculator) for Computer Aided Assessment.
- Research Project in Teaching and Learning – Small Grants Scheme.
- Already in existence: AIM.

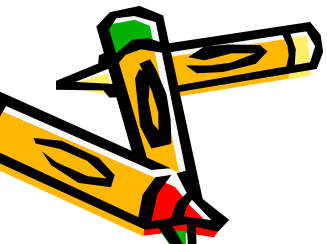


AIM:

http://allserv.rug.ac.be/~nvdbergh/aim_rug/docs/.

Web-based system designed to administer graded tests with mathematical content. Main features:

- *Use of Maple as engine and implementation language;*
- *Several methods of giving partial credit;*
- *Various feedback mechanisms;*
- *Randomization of quizzes and questions;*
- *Versatility in question and quiz design;*
- *Extensive grade reporting and monitoring capabilities;*
- *Ability to collect surveys;*
- *Web interface for both teacher and student.*



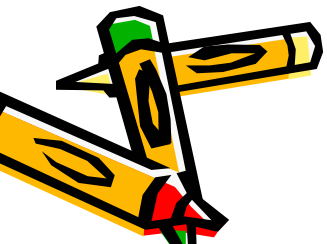
Why chose AIM?

1. Maple:
   - Embedded into first-year Mathematics and taught in another first-year module;
   - University has a 10K site-licence –free;
   - Used by many staff as a research tool;
2. UK Universities already utilizing AIM: Birmingham; Sheffield; York (Gustav Delius).

Example: MATH1711 (Reporting) – "Ellen".

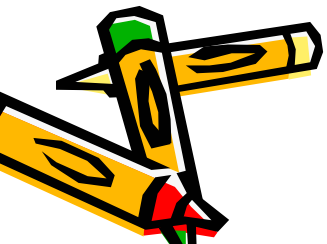
Project students implemented AiM into MATH1711;

- CAL: to deliver Computer Practicals and formatively marked students as they went along - the "Relevance of Practicals" increased.
- CAA: two electronic only assessed assignments and one either on-line or by hand - vast majority of the class were in favour of *some* summative electronic assessment.
- AiM cannot replace a proof or follow through a calculation or spot where a student went wrong – unless you tell AiM to trap that error.



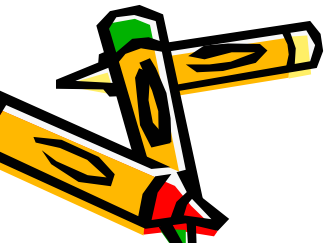
Future for AiM

- Collaboration with York to share good-practice & materials – resulting in JISC application;
- Self-service Maple worksheets where students are tested automatically;
- Over summer other modules will have AiM component.



Pan european test carried

- Five european countries
- Overall Durham students did best – atypical students
- See transparencies



End!