18 Months at the HELM

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HELM (Helping Engineers Learn Mathematics) is a major three-year curriculum development project undertaken by a consortium of five universities, Loughborough, Hull, Reading, Sunderland and UMIST, funded by a FDTL4 grant of £250,000. It is now in its second year and in this article we look back on progress and events during the first 18 months and forward to final trialling during 2004-05.

HELM Project

HELM aims to enhance the mathematical education of engineering undergraduates by the provision of a range of flexible learning resources in the form of workbooks and web-delivered Computer Aided Learning (CAL) segments. These incorporate engineering exercises and case studies closely related to the mathematics presented. In addition, **HELM** makes extensive use of a Computer Aided Assessment (CAA) regime to drive student learning of engineering mathematics and provides both an integrated web-delivered CAA implementation and an alternative stand-alone CD based version. This CAA regime is essential to exploit the full potential of the other **HELM** learning resources.

A list of the Workbooks available now and planned is appended to this article. You can keep up to date with progress by visiting the **HELM** website at: http://helm.lboro.ac.uk/.

HELM Workbooks

We are on target to complete all Workbooks by the end of 2004. We have 38 ready for trialling now, will have 5 more ready in May 2004 and another 7 ready for October 2004, giving a total of 50, 10 more than the project's initial target of 40. Far more Statistics material has been produced than the modest amount that was initially planned. At the request of triallists, an additional Workbook on Trigonometry has been commissioned and completed. Others on Z-Transforms and Optimisation are being produced.

All the Workbooks will have been critically read and revised by the end of Year 2, ie September 2004. The writing team has been drawn from all five consortium partners. Despite some problems due to illness and changes of personnel, the project is on target to complete its work on time.

HELM CAL Segments

We have just completed an appraisal of the existing 67 CAL segments with a view to revising and enhancing them, although this was not envisaged in the original plan. Furthermore, additional funding from Loughborough University will allow staff time for the development of some Statistics CAL segments (to be completed by Summer 2004). Other additional CAL segments may be developed in response to feedback from triallists during Year 3 of the project.

HELM CAA

Checking of all the 3600 CAA questions has been completed, and errors rectified. This has revealed the need for specific feedback for a number of questions where only generic feedback is currently provided. Full CAA trialling using Question Mark Perception software has taken place at another University and is providing useful feedback. Further triallists for this material are invited.

HELM Learning Resources ***1st April 2004***

No.	Title	Workbook ready to trial
1	Basic Algebra	Now
2	Basic Functions	Now
3	Equations, Inequalities and Partial Fractions	Now
4	Trigonometry	Now
5	Functions and Modelling	Now
6	Exponential and Logarithmic Functions	Now
7	Matrices	Now
8	Matrix Solution of Equations	Now
9	Vectors	Now
10	Complex Numbers	Now
11	Differentiation	Now
12	Applications of Differentiation	Now
13	Integration	Now
14	Applications of Integration 1	Now
15	Applications of Integration 2	Now
16	Sequences and Series	Now
17	Conics and Polar Coordinates	Now
18	Functions of Several Variables	Now
19	Differential Equations	Now
20	The Laplace Transform	Now
21	The Z Transform	Apr-00
22	Eigenvalues and Eigenvectors	Now
23	Fourier Series	Now
24	The Fourier Transform	Now
25	Partial Differential Equations	Now
26	Functions of a Complex Variable	Now
27	Multiple Integration	Now
28	Vector Calculus 1	Apr-00
29	Vector Calculus 2	Apr-00
30	Introduction to Numerical Methods	Now
31	Numerical Methods of Approximation	Now
32	Numerical Solution of Initial Value Problems	Jun-04
33	Numerical Solution of Boundary Value Problems	Jun-04
34	Numerical Optimisation	Oct-04
35	Sets and Probability	Now
36	Descriptive Statistics	Now
37	Discrete Probability Distributions	Now
38	Continuous Probability Distributions	Now
39	The Normal Distribution	Now
40	Sampling Distributions and Estimation	Now
41	Hypothesis Testing	Now
42	Goodness of Fit Tests and Contingency Tables	Now
43	Correlation and Regression	Now
44	ANOVA	May-04
45	Nonparametric Methods	Jun-04
46	Quality Control and Reliability	Now
47	Case Studies 1 - Modelling Motion	May-04
48	Case Studies 2 - Modelling Waves	Oct-04
49	Case Studies - Engineering Applications	Jun-04
50	Tutor's Guide	Sep-04 draft
0	Student's Guide	Sep-04 draft

The CAA development of a stand-alone CD was a considerable success in Year 1 and this is being built upon in Year 2, with a revised CD to be produced in the summer, and the development of more sophisticated feedback systems.

HELM would welcome more CAA questions. So if you can help, please get in touch by email: helm@lboro.ac.uk.

HELM Project Manager

A number of factors led to a rethink of management of the project. First, the scale of the project has made progress-chasing particularly difficult. Second, as large-scale trialling begins to get underway, it has become apparent that the evaluation management will need considerable support with organisation and monitoring to provide adequate feedback.

Consequently, it was decided to appoint a Project Manager, who will work part-time on a daily basis, and Dave Pidcock has now been in post from January 2004. You can contact Dave directly via telephone 01509 227467 or email D.Pidcock@lboro.ac.uk. A major strand of Dave's role will be the support of the trialling and related evaluation effort. He is also looking after the CAA databank.

HELM Workshop Reports

HELM has held four successful workshops to-date, three in Loughborough and one in Manchester. A fifth is planned for Reading on 23 June 2004.

Engineering Examples & Case Studies Swap-Shop
29 January 2004, Loughborough

The **HELM** project is collecting engineering examples and case studies to support its mathematics learning resources. This Swap-Shop, organized in conjunction with the LTSN Engineering, was designed to allow delegates to both present and take away engineering mathematics examples and case studies from the other presenters and delegates. In spite of the miserable weather and dire travelling conditions, over 20 people turned up to participate.

Following brief introductions by Sarah Williamson (LTSN Engineering) and David Green (**HELM** Project), Alan Stevens of Rolls-Royce started the day with a stimulating talk on the use of mathematics in industry drawing on his own experiences of mathematical modelling and simulation over many years at Rolls-Royce.

Keith Attenborough (Department of Engineering, University of Hull and **HELM** Project) then outlined the need for Engineering Mathematics Examples and Case Studies.

Other speakers, Chris Rielly (Department of Chemical Engineering, Loughborough University), Neil Challis (School of Science and Mathematics, Sheffield-Hallam University), Roger Crouch (Department of Civil and Structural Engineering, University of Sheffield) and John Martin (School of Computing, Science and Engineering, University of Salford) then gave a range of interesting talks on a broad range of topics in engineering mathematics. For full details, visit LTSN Engineering's web page at

http://www.ltsneng.ac.uk/nef/events/helm.asp.

Much of this material, both engineering examples and case studies, will be used by the **HELM** project in its mathematics learning resources.

HELM would welcome ideas for more engineering examples and case studies. So if you can help, please get in touch with Keith Attenborough by email: K.Attenborough@hull.ac.uk.

Triallists' Workshops
17 December 2002, Loughborough
30 June 2003, UMIST
30 January 2004, Loughborough

The principal aim of the first two workshops was to recruit triallists for the 2003-04 session. Sessions featured:

1. work completed and planned by the **HELM** consortium
2. CAA and the **HELM** assessment regime and its implementation at triallists' institutions
3. the role of **HELM** triallists and critical readers
4. evaluation issues.

As in previous workshops, the third **HELM** triallists' workshop allowed potential triallists to try the **HELM** resources for themselves. In addition current triallists from Leicester and Salford spoke positively of their experiences of using **HELM** resources.

Next Triallists' Workshop
Friday 23 June 2004, Reading

The next Workshop will be held at the University of Reading on 23 June 2004. Users will report on some of the semester one and two trials undertaken in 2003-4 at other universities. This Workshop will also look towards planning final trialling in 2004-5 by existing and **new** HEI triallists.

Full details about this workshop will be found at: http://helm.lboro.ac.uk/.

We can provide some **financial support** towards the cost of travel expenses to **HELM** workshops.

HELM Trialling

HELM learning resources have been extensively trialled at Loughborough University over a number of years to teach mathematics to several thousand engineering students and trials are currently taking place at over 20 HEIs in the UK. The resources may be used to support the teaching of a complete mathematics module, or part of it, for engineering students and many have commented very favourably on them. Alternatively students can use the resources for independent learning.

New triallists are being recruited on a regular basis, which is a clear indication that the **HELM** project is well-known and is seen as of value to the community. The project therefore has a very firm basis on which to build.

HELM triallists include:

- Aston University
- Bournemouth and Poole College
- City University
- Glasgow Caledonian University
- Glenrothes College
- University of Hull
- University of Leeds
- University of Leicester
- University of Liverpool
- Loughborough University
- University of Manchester Institute of Science and Technology
- Moray College
- Northumbria University
- Oxford Brookes University
- Queen's University Belfast
- University of Reading
- University of Salford
- University of Sunderland
- University of Surrey
- University of Ulster
- Upper Bann Institute

HELM triallists can access **all** the learning resources **free**. They can:

1. Use the high quality printed **HELM** workbooks (also available in pdf format). We can provide masters of the printed materials so that trialling institutions can prepare their own student copies.
2. Use the associated **HELM** CAL segments by accessing the **HELM** CAL web site.
3. Try the **HELM** assessment regime and we can advise on Computer Aided Assessments.

We are now offering HE institutions the opportunity to take part in our final **HELM** trials in 2004-05. Offers to trial the newly developed statistics workbooks would be especially welcome.

All we ask of triallists is some feedback from both staff and students on the resources for which we can provide suitable questionnaires.

Note that a member of the **HELM** project team can visit HEIs to demonstrate **HELM** materials or visitors are welcome at the project HQ in Loughborough.

To become a **HELM** triallist or to arrange a visit or to simply find out more, please contact the **HELM** project by email: helm@lboro.ac.uk.

HELM Conference 2005

The **HELM** project is now in its second year and more and more resources are becoming available. Dissemination of all the **HELM** resources will be at an end-of-project **HELM** sponsored conference in September 2005.