The HELM (Helping Engineers Learn Mathematics) project was a major three-year curriculum development project undertaken by a consortium of five UK universities, Hull, Loughborough (the lead institution), Manchester (then UMIST), Reading and Sunderland, and sponsored by UK government funding from October 2002-September 2005. It used the expertise from consortium partners and computer technology to enhance the mathematical education of engineering undergraduates through the development of a range of flexible learning resources in the form of Workbooks and web-delivered interactive courseware elements together with an integrated web-delivered CAA (Computer Aided Assessment) implementation. During this phase the focus was on the consortium developing and revising teaching materials which were critically read externally and then trialled piecemeal at a large number of HEIs.

The HELM deliverables were then launched at a special Higher Education Academy conference entitled “Helping Everyone Learn Mathematics” held in Loughborough on 14-15 September 2005 [1]. Professor Celia Hoyles, Government Chief Advisor for Mathematics, gave the Keynote Speech.

HELM Educational Transfer

During 2005-06, the HELM team worked with six further UK universities, Leicester, Oxford Brookes, Portsmouth, Newcastle, Nottingham and Salford, to enable the resources to be exploited and evaluated at other HEIs. The overall purpose of the HELM educational transfer project was to encourage the effective transfer of practice across institutions. We had four aims:

- to convert some HEIs who had been involved with trialling and some newly identified potential HEI users into long-term users of HELM materials
- to monitor and support six HEIs using the HELM project deliverables in different pedagogic ways;
- to evaluate the experience of transferring HELM to other institutions and identify the critical success factors; and
- to produce a report that would enhance the existing Tutor’s Guide to further aid transferability.

During this phase, the emphasis was primarily on the six partner HEIs trialling the materials and integrating them into their own provision and performing their own evaluation. In June 2006, we held a symposium of all six HEIs together with members...
of our Steering Group and representatives from the Higher Education Academy Subject Centres in Engineering and MSOR. We were impressed by the work our partners had done and pleased that the resource development was extended in unanticipated ways, in particular by the development of video material at Newcastle and the production of acoustic examples to accompany sections of some first level HELM workbooks at Salford.

At the end of the transferability phase, HELM then disseminated the outcomes to all participants at the Higher Education Academy’s CETL-MSOR Conference 11-12 September 2006 at Loughborough University [2, 3]. We have been encouraged by the continuing interest in HELM seen by the number of institutions that have now become HELM users. At present there are 99 registered HELM users spanning 69 institutions; of those 69, 47 are in England (39 HE and 8 FE), 5 in Northern Ireland, 8 in Scotland, 2 in Wales, 5 in the Republic of Ireland and 2 Ex-UK, one in the Netherlands and the other in New Zealand.

HELM Trialling

HELM learning resources have now been extensively trialled at Loughborough University over a number of years to teach mathematics to several thousand engineering students and at many other HEIs and FEIs 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.

The success of the transferability phase can be seen from some of the comments received both from the HEIs and their students:

- "We have embedded the extensive range of high-quality Workbooks within our existing web-based support giving Engineering (and Science) student’s additional choices in their learning preferences."
- "The ready availability of the resources has enabled teaching staff to incorporate the resource within their own teaching."
- "Recently the University has decided to adopt QMP as a web-based CAA-tool and this will enable Mathematical Sciences to evaluate further use of the HELM databank of over 5000 questions to support student learning."
- "We can verify that the inclusion of HELM resources has been popular with students and has made a significant contribution to ‘Level 1’ pass rates, student mathematics attainment and more generally student learning skills."
- "We suggest that to optimise the effectiveness and popularity of HELM workbooks and CAA, module coordinators should consider restructuring lessons plans HELM central as opposed to supplementary to student learning of mathematics."
- "And from a student: “…I am a student studying aeronautical engineering and have recently come across a few of your workbooks. Upon reading them, I found them to be very helpful and easy to understand…” (Student, BAE Systems)

HELM Learning Resources

There is a clear need for more flexible mathematics learning resources due, in particular, to the increasing diversity of university intake standards. HELM provides a solution through: Workbooks available in web-based or paper-based forms; web-based interactive lessons; a CAA regime which enables regular testing to drive the student’s learning. The large question bank, which can be used for formative and summative assessments, is available either web-delivered or on CD.

The HELM Workbooks encourage student engagement during lectures; the HELM interactive lessons complement the workbooks and aid understanding; the HELM CAA, with flexible access via web delivery, facilitates regular testing of large numbers of students, provides instant feedback and incorporates both formative and summative testing which helps drive student learning.

The learning resources can be used in different pedagogic ways and are popular with staff and students alike. They comprise:

- 50 Workbooks: As well as covering the mathematics essential for engineering undergraduates, the 50 Workbooks incorporate engineering examples and case studies closely related to the mathematics presented, a Student’s Guide and a Tutor’s Guide (see Editorial Comment).
- CAL courseware: CAL courseware, consisting of on-line interactive lessons to aid understanding, is web-delivered and supports 23 Workbooks.
- CAA: An extensive CAA regime, which facilitates the regular testing of large numbers of students, is used to drive student learning with over 5000 questions supporting the Workbooks. It takes two forms, either an integrated web-delivered version or an alternative stand-alone CD-based version. The CAA regime, which can be used for both formative and summative assessment, powerfully encourages students to engage more in their own learning and has been essential to the success of the project.

Availability and Continuity

The HELM deliverables, revised in the light of the transferability phase experiences, were re-issued in September 2006 to all registered users of HELM. They are available on CD and via the web as follows:

- CD ROM 1: Containing following HELM materials:
• PDF files of all 50 workbooks.
• Sample stand-alone assessments (PC based), which do not require QMP.
• Demonstration of Courseware via Interactive Lessons and Interactive Revision.
• Information on contacting the project and accessing Web based Courseware.

CD ROM 2: Containing the HELM CAA question database and associated image and template files for those institutions that have access to QMP. Available on request to the project.

COURSEWARE: Web-based access available upon request to the project.

Loughborough’s Mathematics Education Centre, which has been awarded Centre for Excellence in Teaching & Learning status, has now taken responsibility for distribution of the HELM learning resources to enable effective continuation. These resources are available to all HEIs and FEIs who would like to use the materials (freely to those in England and Northern Ireland). Continuity will be maintained via the sigma-CETL, http://www.sigma-cetl.ac.uk, who will:
• Maintain the HELM website
• Maintain the written materials (in electronic form)
• Hold the CAA Question Bank

For further information visit the HELM website: http://helm.lboro.ac.uk
To contact HELM email: helm@lboro.ac.uk

Acknowledgement

The Higher Education Funding Council for England (HEFCE) for support through the Fund for the Development of Teaching and Learning phase 4 (FDTL4).

References


Notes to article

1 Questionmark Perception [4]