A PILOT PROGRAMME INTO THE USE OF BLACKBOARD TO SUPPORT THE TEACHING OF ENGINEERING UNDERGRADUATES

Elizabeth M Laws[1]

Abstract ¾ *Supporting engineering students throughout their studies places a heavy demand on academic staff time. Increasingly it is necessary to provide help outside the schedule lecture and tutorial periods and to cope with a range of student abilities. An efficient and effective way of providing this is through E-learning and at Salford, the Blackboard Web portal has been used to provide this support. Through the use of Blackboard a convenient and effective means of facilitating student learning has been arrived at. Blackboard can provide a means of communicating directly with individual students, monitoring student activity, conveniently packaging course materials, providing on-line assessments and giving support which extends beyond the scheduled semester period and normal working day which can be accessed by students when they are away from the University. This ability to remain in contact outside the University teaching period makes Blackboard an ideal means of support during revision periods and also a suitable resource for students, who for one reason or another have to resit failed modules. The benefits to be gained from adopting an E-Learning approach will be developed. Information on student usage of the sites will be included and the results of student surveys undertaken will be presented.*

Index Terms- E-learning, Interactive learning. VLE

INTRODUCTION

The teaching of engineering undergraduates is demanding with typical class contact hours being considerably greater than for other degree subjects. Level 1 on most programmes includes an element of revision and balancing as students from disparate engineering backgrounds and systems are brought to the same end-point in preparation for more demanding topics at levels 2 and 3.

The hierarchical nature of most module topics means that any inherent weaknessses in the early stages are amplified in later stages of study thus the foundations of the topics at level 1 is of critical importance to future study although it is usually the case that level 1 examination performance does not contribute to final degree classification.

With widening participation a key element of the higher education agenda satisfying the learning needs of individual students is increasingly difficult. No longer are entry qualifications narrowly prescribed, (even under SARTOR 3 guidelines), and the end-result is increasingly a wide-ability student cohort with individual strengths and weaknesses.

Even with well motivated and dedicated staff the demand for support and the varying nature of each individual student's demand stretch the limits of the system. E-learning systems are one means of bridging the gap between lecturer and student providing a convenient and practical way of both facilitating student learning and motivating students effectively. At Salford a pilot scheme using the Blackboard 5 Educational web portal, [1], has been running. As part of the pilot scheme it has been used as a student resource to support a number of level 1 engineering modules during the session 2000-2001 and extended further into level 2 modules in the session 2001-2002.

THE INITIAL STAGE

As a novice in the E-learning stakes and without formal guidance the approach adopted was a simple one. The hard-copy material already provided for students in the form of printed material was simply re-packaged in bite-sized chunks and posted to Blackboard.

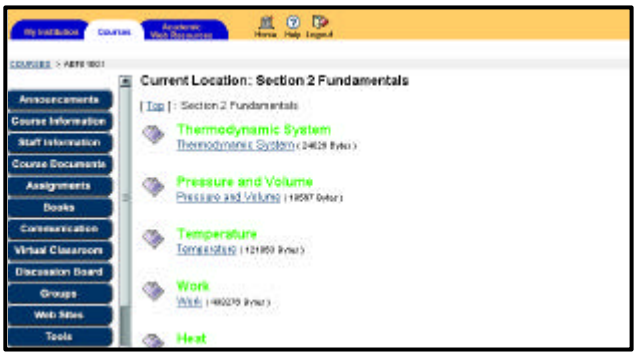

FIG 1 BLACKBOARD 5 ENTRY SCREEN

The advantage of this was that immediately any restriction to black and white was eliminated and colour could be retained. Thus in the e-learning envronment it was possible to present material so that it had visual impact with important concepts or equations emphasised. Whilst this may not seem significant, experience shows that today's students need visual stimuation to structure learning, the number who are able to successfully extract this from the printed page unaided or un-guided are dwindling.

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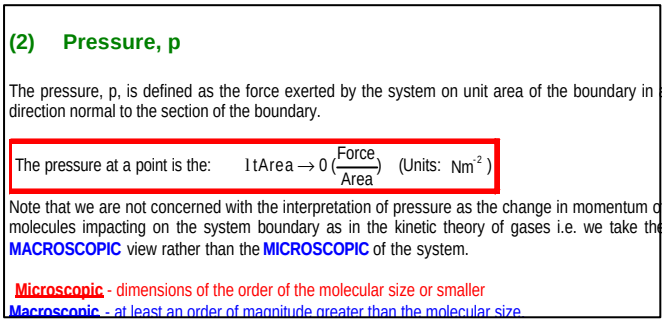

FIGURE 2 SAMPLE MATERIAL PAGE

Another advantage of the VLE platform was almost parodoxically the relationship and rapport that could be developed between lecturer and student.

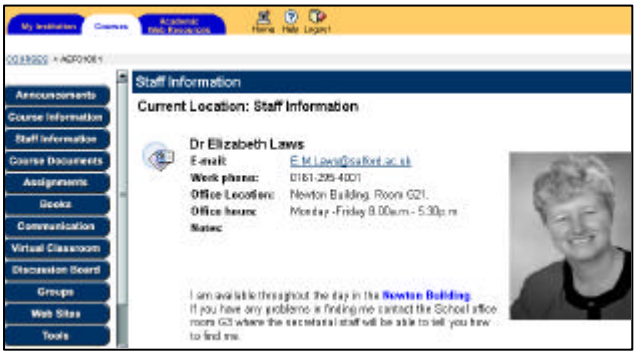

FIGURE 3 STAFF INFORMATION ENTRY PAGE

Whilst on one-hand the move to VLE distanced physically the deliverer and the student the communication provided through the VLE had distinct and identifiable advantages over traditional delivery methods.

For the lecturer it was possible to interrogate the system to find out who had done what and when. Through observation of the results of the on-line assessments provided it was possible to judge an individual student's progress and if necessary provide tailored support and guidance to address at an early stage areas of difficulty.

For the student the facility to easily contact the lecturer via e-mail through the VLE to ask for help was a definite bonus enabling even the most reluctant student to seek help.

For the two level 1 modules for which Blackboard was used in the academic year 2000-2001, Engineering Thermodynamics and Fluid Mechanics, the following priorities were identified.

1 The provision of all the course notes packaged in a form readily accessible to students.
2 The inclusion of the tutorial exercises followed later by the corresponding solutions.
3 On-line assessments which were timed to fit in with the appropriate stage of the course delivery.
4 Access to past examination papers as the end of module approached.

FEEDBACK OBTAINED

The results obtained from the first module supported through Blackboard were encouraging. Many students commened favourably on the support they had received through Blackboard in the module evaluation.

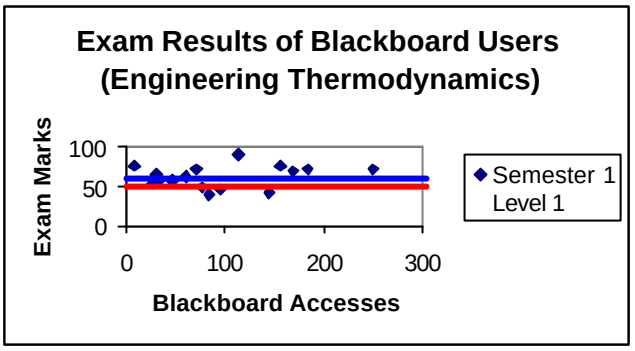

FIGURE 4 CORRELATION BETWEEN BLACKBOARD USAGE AND EXAMINATION PERFORMANCE

Module Average 51% Blackboard Users 59.5% Non-Blackboard Users 45%..

Whilst not every student with access to the resource used the resource analysis of the examination results at the end of semester 1 was very positive. No user of Blackboard failed the module and the module average of those using Blackboard was 15% higher than those who chose not to use it .

A steady use of Blackboard throughout the semester was evident though not all students elected to use it with a definite crescendo prior to the examination date. Over the Christmas vacation period whilst students were at home and revising there was a continued use of the site. Unfortunately due to a re-configuration of Blackboard over that period this usage data was lost.

Whilst considerable effort had been placed on putting on-line assessments on the site there was an apparent in-built reluctance for students to tackle these - even with the inducement of an end of session trophy as a reward. This it was suspected is that these assessments did not form part of the formal assessment for the module. This was overcome to a certain extent by printing out the tests and requirng students to undertake them in tutorial sessions. More latterly this problem has been addressed using the PRS system[2], (Personal Response System), described later in this paper.

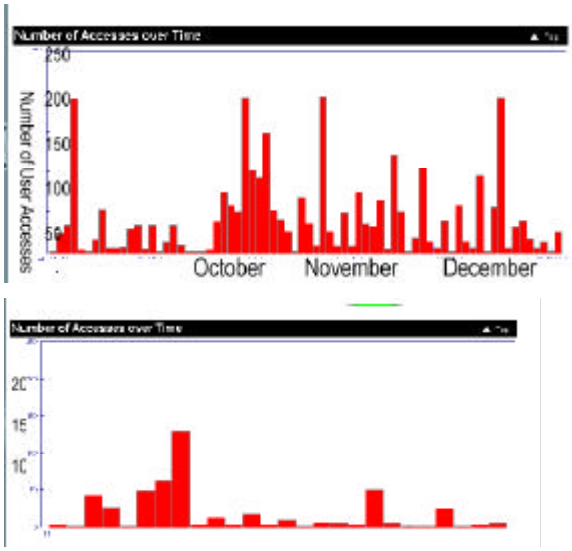

FIG 5 MODULE ACCESSES ENGINEERING THERMODYNAMICS (2001-2002)

THE SECOND STAGE

For the second module for which Blackboard was used Fluid Mechanics, a semester 2 module, a similar site was produced and slightly more adventurous assessments were attempted. Also for this module the laboratory programme for which self-running PowerPoint presentation had been prepared previously was also built into the Blackboard site. This enabled students to study the laboratory exercises prior to the scheduled laboratory session and arrive fully prepared.

Again a steady take up of users throughout the module was established and a good correlation between Blackboard usage and module success evident.

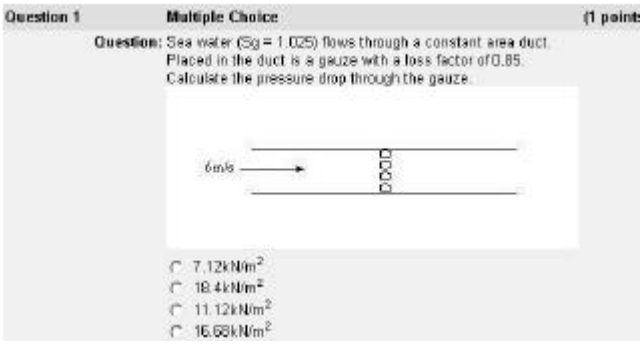

FIG 6 SAMPLE MULTIPLE CHOICE QUESTION FLUID MECHANICS

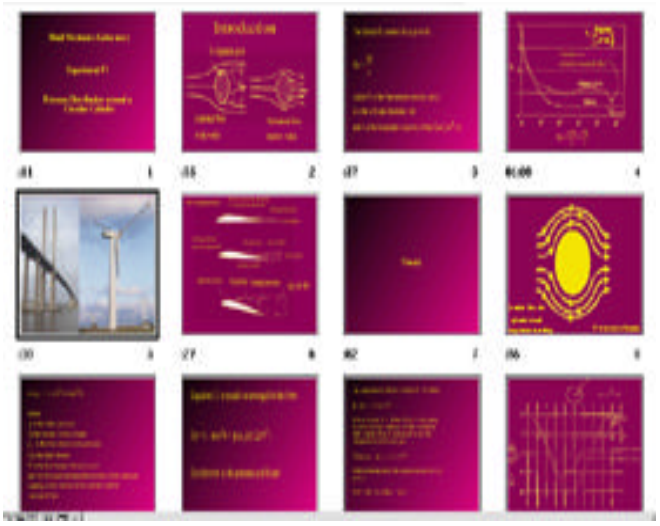

FIG 7 FLUID MECHANICS MODULE POWERPOINT PRESENTATION AVAILABLE THROUGH BLACKBOARD

The summer vacation allowed some time for reflection and evaluation of the progress made to date and identification of any changes to be made in the academic year 2001-2002. Because of the benefits gained it was decided to continue with Blackboard and to extend the use to other modules.

During the academic year 2001-2002 Blackboard sites to support the initial modules, (Engineering Thermodynamics and fluid Mechanics), were maintained and new sites supporting Solid Mechanics at level 1 and Aerofluid Mechanics and Aircraft Design at level 2 were developed. In addtion Blackboard was used to support our industrial placement activities.

There was also time to review other E-learning sites and to provide useful Web access links into the Blackboard sites to include an element of interactivity. Whilst the Web is a tremendous resource for students it can be tremendously time consuming to locate a particualr site and evaluate its usefulness. Blackboard provided a means of building in Web links which were such that they dovetailed closely with the module content.

This facility was found to be particularly useful in the support of the level 2 module Aerofluid Dynamics E2.1 a module, taught to both Aeronautical and Mechanical Engineering students, which ran for the first time in semester 1 for the academic year 2001-2002 replacing two previous modules Fluid Mechanics E2.1, which was taught to Mechancial Engineering students and Aerodynamics E2.1 taught to Aeronautical Engineering students.

The essential elements of both of these earlier modules were the same, ideal potential flow and one-dimensional

compresible flow theory. The economy of scale by teaching the two cohorts in common was considered to be advantageous hence the move to the common module entitled Aerofluid Dynamics.

In preparing the Blackboard module to support Aerofluid Dynamics in addition to providing the coursenotes, tutorials and solutions and the powerpoint versions of the laboratory exercises some effort was placed into finding appropriate Web sites and links to which students could turn to easily. Though these links an element of interactivity could be built into the site which added both stimulation, interest and the ability for students to test out particular applications 'live'.

Thus for the Aerofuid Dynamics module the following links were provided:

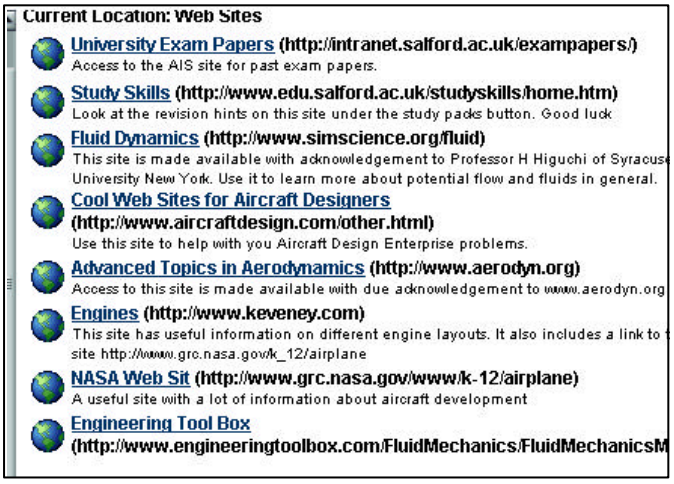

FIG 8 WEB SITE LINKS -AEROFLUID MECHANICS

As an example the Fluid Mechanics[3] site proved to be an ideal support resource allowing students to run Java applets covering both compressible and potential flows.

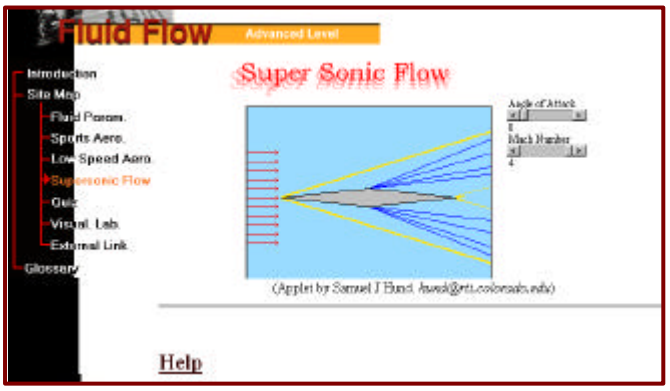

FIG 9 COMPRESSIBLE FLOW APPLET FROM REFERENCE 3

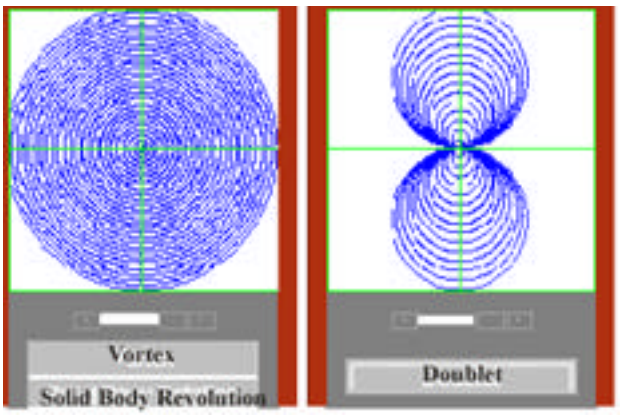

FIG 10 POTENTIAL FLOW APPLETS FROM REFERENCE 3

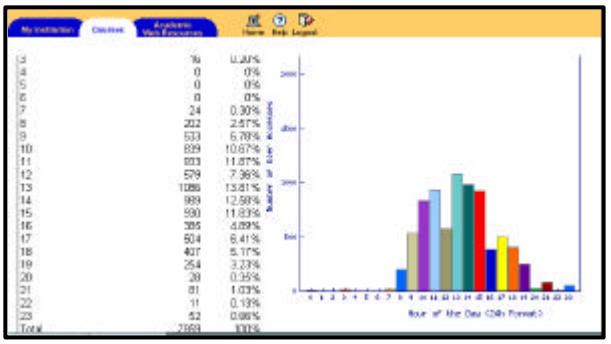

FIG 11 USAGE OF THE AEROFLUIDS MODULE 2001-2002

Most of the students using the sites at level 2 had been introduced to the use of Blackboard at level 1 thus it was easier to get them to engage with it and more of them appreciated the benefits to be gained Since the level 2 module was underpinned by the earlier modules of fluid Mechanics and Engineering Thermodynamics the level 2 students were still given access to the level 1 sites so that if they needed to revise any level 1 material they could use Blackboard to do so. In addition to the site for Aerofluids a site was also developed to support the Design Enterprise undertaken at level 2. In this activity students work in groups to fulfill a particular design brief. The ability to provided through Blackboard to organise students in groups and to enable them to communicate via e-mail and to transfer material within their group improved the running of this module. Even when a student was absent from a scheduled group meeting they had no excuse for failing to produce the required deliverable.

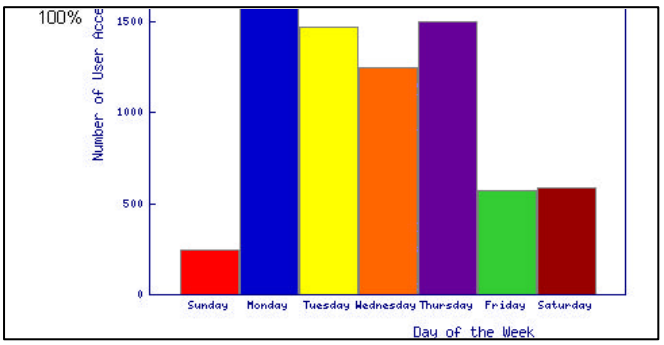

FIGURE 12 USAGE OF AEROFLUIDS SITE THROUGHOUT THE WEEK

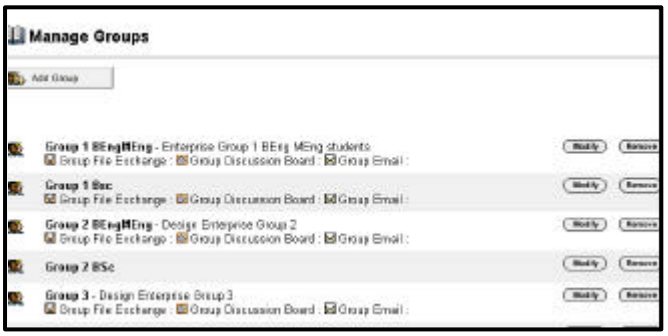

FIG 13 GROUP MANAGEMENT FACILITY OFFERED IN BLACKBOARD

Surveying the usage of the Aerofluids site during semester 1 of the 2001-2002 academic year showed a steady take up of use spread throughout the week with a reduced, though still signifcant, level of usage at weekends. Looking at the time of day that these accesses occur revealed the interseting phenomenon that a small number students used the resource either very late at night or during the early hours of the morning.
Studying the parts of the site used by students on the Aerofluids module the majority confined their attention to the main content and communication areas.

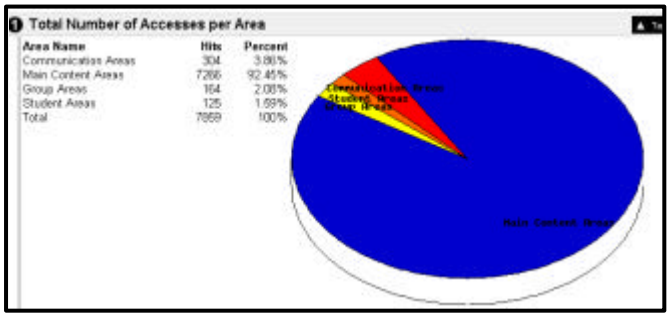

Fig 14 PIE CHART SHOWING USAGE OF THE FLUIDS SITE

For the Aircraft Design Enterprise as might be anticipated much more use of both the group areas and communication areas was evident. Whilst the only material placed in the course document section was the project brief the students used the site to communicate and to engage and extract source information from the Web Sites built in to the site. A similar nocturnal trend to usage was displayed.

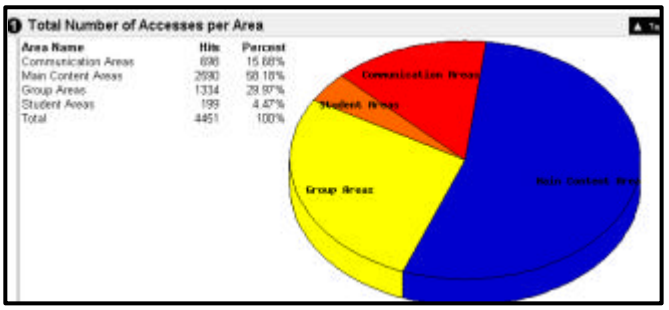

FIGURE 15 USAGE OF THE AIRCRAFT DESIGN BLACKBOARD SITE

FURTHER DEVELOPMENTS

Once involved with e-learning the literature on the topic became relevant. As a novice I found great support from Horton[4]. Had this text been studied prior to embarking on the work perhaps progress might have been made quickly. Nevertheless wih hindsight it was found that the strategy recommended in Horton had been followed.

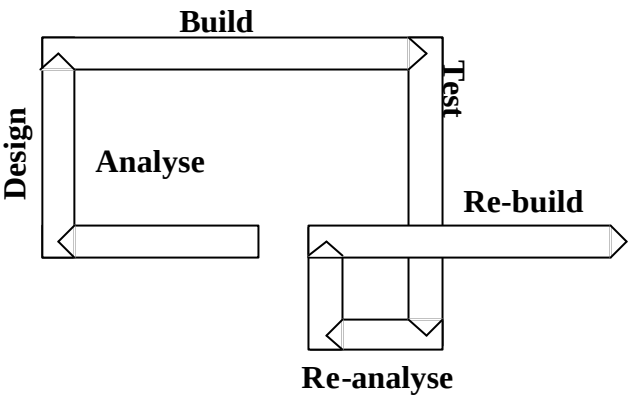

FIGURE 16 THE DESIGN PROCESS (HORTON[4])

The iterative nature of the design process would appear to be inherent so that the e-learning material evolves over a number of iterations and phases. In the case of my own work each iteration is spread over a fairly long time-scale as once the semester starts time pressures and other work

demands prevent any major changes to be made until the end of the semester. Whilst Horton advocates the design cycle illustrated in Fig 18 it may be the case that the 'finished product' never actually materialises since continual changes to module content occur over time and a stable position will never be wholly sustainable. In the author's experience this is the main advantage in ensuring that the content developer is also the instructor/teacher of the module so that changes to material can be initiated in a one-step pass.

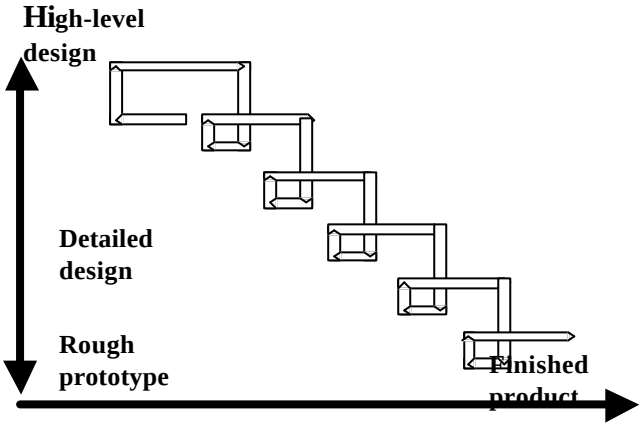

FIGURE 16 THE DESIGN CYCLE (HORTON[4])

Once tuned in to alternate methods of engaging student interest, attention and stimulating student learning a more pro-active approach to teaching is created. For example in approaching the Blackboard assessments which, as has already been mentioned students were relauctant to engage with the PRS[2] system marketted by Educue has been employed. Using this system students answer multi-choice questions posed in a lecture/tutorial context via hand-held personal remote control devices which they direct towards a transmitter linked to a computer running the PRS software.

Through the software it is possible to set the time to answer questions and to monitor student responses 'live' before gauging whether to proceed further with a topic. In addition to maintaining a grade book it is possible to use the PRS system to monitor student attendance at scheduled events. Initial student feedback to the use of the system were exceedingly positive.

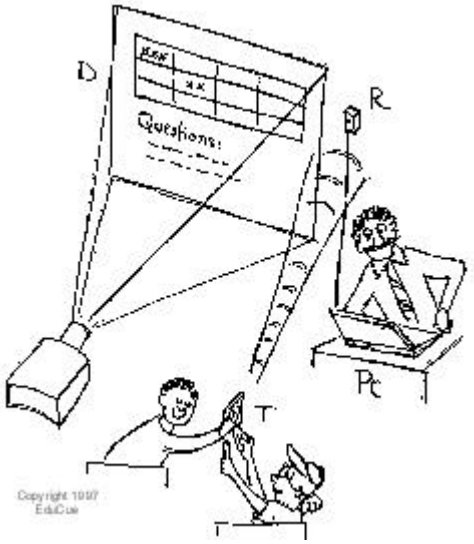

FIGURE 18 THE PRS SYSTEM (EDUCUE[2])

CONCLUSIONS

Positive benefits have been identified linked to the use of an e-learning support strategy to assist in engineering education. These benefits have been demonstrated both in terms of improved student performannce interest and in general engagement with the learning process. Whilst the work invoved in adopting an e-learning atrategy is considerable the ability to re-use, enhance and further develop the material over time gives lasting benefits which in the medium-long term more than repay the time outlayed in development. The spririt of collegiality engendered between staff and students through this medium was a surprising spin-off from the pilot scheme.

REFERENCES

1 Blackboard http://www.blackboard.com
2 PRS http://www.educue.com
3 Fluid Mechanics http://www.simscience.orgfluid
4 "Designing Web-Based Training". W.Horton, Wiley, ISBN 0-471-35614-X