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## 4. Mathwise in use

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**Course : 1<sup>st</sup> year Mathematics**

**Software : TLTP Mathwise**

**This case study describes an implementation where students were involved in formative evaluation of software, in addition to it being part of their course. The main lessons from this implementation were:**

- **the effectiveness of computer based packages can be enhanced by the inclusion of self assessment questions.**
- **the computer can be used to go beyond what is feasible in traditional approaches to teaching.**
- **there is a need for research to maximise the effectiveness of computer based materials.**

### **Aims and Objectives**

Mathwise is a set of modules covering first and second year university level mathematics, produced by the UK Mathematics Courseware Consortium, within the TLTP. The aim of the consortium was to produce computer-based materials which could be used on a student-centred basis. A set of more than 30 such modules has been written.

At the University of Paisley one of these modules, "Complex Numbers", has been used on two courses on an experimental basis. It was anticipated that this could result in improved efficiency of course delivery and enhanced quality of learning experience for students, compared with that attainable using traditional teaching methods.

### **Overview of the Project**

Delivery in both the courses in which Mathwise has been used is partly traditional, using lectures, and partly computer-based, using sessions in the Mathematical Sciences Laboratory. It was felt that there was a danger of students clicking aimlessly through pages,

so that some guidance was necessary. Paper-based worksheets were produced in-house to accompany the Mathwise software. These worksheets gave introductory instructions on navigation and some advice on which parts of the module to cover in each one hour session.

Integration was not found to be a significant problem, as Mathematical Sciences Laboratory classes had been in operation at Paisley for many years, so that the department was well set up to take the new Mathwise software on board. Staff in the department have gained considerable experience in small group work with students over many years, so that they have developed the necessary inter-personal skills for the more interactive computer-based approach to work successfully.

The Mathwise software was found to be sufficiently user-friendly that students could use it quite easily without any additional training, particularly when it was supported by the accompanying worksheets. The main thing which needed emphasis was that students should work their way slowly but thoroughly through a small section, rather than try to cover too much material too superficially.

However, there were implications for the provision of hardware, as the department's existing 386 machines ran the software somewhat slowly. The necessary upgrading has subsequently been undertaken.

### **Evaluation**

During the initial phase of evaluation, in the 1994-95 session, student assessment was carried out by means of a traditional paper-based test. The results of this indicated that the introduction of Mathwise had been successful in enabling the students to learn about complex numbers.

The principal shortcoming identified during formative evaluation was the lack of short tests on screen. This tended to result in students clicking quickly through pages without ensuring that they had understood the content. As a result of comments received this deficiency was rectified, so that the final version contains appropriate on-screen tests at

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strategic points within the software. The latest version of the module contains both formative and summative assessment facilities on-screen.

It was found that students tended to work much more effectively when a worksheet was provided containing brief operating instructions and guidance. They found it very helpful to be advised on which pages and exercises they should concentrate during any one session.

It is anticipated that the results of the full evaluation will be published separately.

### **Outcomes**

As well as being an effective tool in course delivery, it has been found that Mathwise is of particular value for review and revision. The University of Paisley has a Mathematics Support Unit in which the Complex Numbers module has been used effectively in this way. A network facility is being purchased which will enable the department to make all the Mathwise modules available in the future.

A real virtue of the computer as a delivery vehicle for mathematics is its interactive capability in terms of moving graphics and visualisation. These are the kind of features that students tend to find particularly helpful, as they involve a use of technology which genuinely goes beyond what is feasible in traditional approaches.

The department is aware that what has been done to date is merely the beginning of an

ongoing exercise in developing teaching and learning strategies for what is still very new technology. Much work remains to be done, both in terms of further development of learning programmes to maximise their potential, and in terms of research to determine their effectiveness. It is suggested that such work would best be carried out on a collaborative basis involving a number of institutions.

### **Conclusion**

To use a system like Mathwise successfully, it is not necessary to abolish all that went before. Given appropriate hardware and sympathetic staff, it sits well alongside a traditional lecture course as an added resource. Some new demands are made on staff, but colleagues are generally able to acquire the new skills fairly painlessly, provided that appropriate support is provided.

The “lecture+computer laboratory” model for a mathematics course provides a good vehicle within which to pilot the use of Mathwise. It may, of course, be possible to use it in ways more radical than this, but at Paisley, we are satisfied that it can at least be used successfully alongside a traditional approach. Mathwise can be used effectively for formative assessment, whereby students test themselves while learning. As for formal examination purposes, we leave it to others to investigate its possibilities.