

LEARNING TECHNOLOGIES

Investigations into the use of Hypermedia in Teaching and Research

TAKING THE HYPE OUT OF HYPERMEDIA

In December 1989, Sheffield University began investigating the use of information technology for flexible learning, a form of learning which is expected to have a major impact on education and training this decade. The project was funded by The Employment Department.

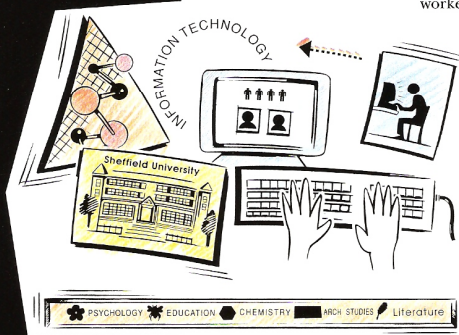
The Challenges Facing Society

In the past, many workers left school equipped with basic skills in literacy and numeracy. A company would, through training, provide its workers with the specific skills required for the

job. In many cases, these would be the only skills used by the employee during his or her working lifetime. But in today's increasingly complex and technological society, workers need to be flexible - they must acquire new skills to face the new challenges and changes at the workplace. In short, more and more employers are requiring workers who are adaptable and flexible.

Conventional teaching has been based around the notion of the 'empty vessel'. In this model, the teacher is an expert who fills the student's head with knowledge and skills. But this type of learning is passive and does not extend a person's ability to learn.

However, flexible learning involves individuals taking greater control and responsibility for their own learning. It is also compatible with the notion that education continues throughout life.



Learning Methods Branch
Employment Department
Moorfoot
Sheffield
S1 4PQ

Request for publications
(0709) 888688

CS19
PP80/12750/593/52

LEARNING METHODS CASE STUDY

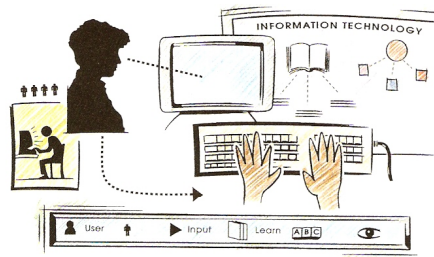
There has been great interest in the use of computers for flexible learning, and a technology known as hypermedia appears to have great potential in this field. Hypermedia offers a way of linking information in the form of sound, pictures, text and graphics. Hypermedia is claimed to be very flexible because it allows the exploration of such information in a variety of ways.

However, systems like hypermedia have been criticised as being 'technologies looking for a solution'. For this reason, extensive research needs to be conducted before any major investments are made in hypermedia. If hypermedia is to be adopted it needs to be shown to be cost-effective, flexible and at least as effective as conventional teaching methods. In short, hypermedia must enable users to do new things or to do existing things more quickly and easily.

The Background

The hypermedia project involved a number of university departments, including Psychology, English Literature, Architectural Studies, Chemistry and Education. The project was divided into two main groups:

- Generic Tools
The aims of this group were to:
 - develop tools for authoring or producing hypermedia materials;
 - evaluate these materials.
- Hypermedia Demonstrators
This group developed three prototype hypermedia systems and evaluated their performance.



Generic Tools

This consisted of three sub-projects.

The use of Information Technology in Initial Teacher Training

A number of Government reports have stressed the importance of schools providing pupils with the skills to use information technology in a confident and competent manner. However, research suggests that teachers still lack computing skills. Through a series of questionnaires and interviews the project examined the major factors affecting the use of information technologies in teacher training courses. The result of the work was a series of recommendations aimed at improving the situation.

A Flexible Learning Package for Statistics

Statistics play an important part in many subjects. Students come to statistics courses with differing levels of ability and so work at different paces. The result is that some students are held up by slower members of the group, who may also take up a lot of the teacher's time. Other students may make mistakes which are not detected until much later into the exercise. Providing one-to-one tuition would be difficult and expensive. The project group produced HELPStats, a

hypermedia version of a standard ten week statistics course. Users work through the course as they would with a conventional book, but use the hypermedia facility to complete exercises in any order they wish and as a means of on-line help via the various information sources.

Using Hypermedia to teach Chemistry

Most chemistry courses are a mix of classroom theory and practical investigations. However, for practical and economic reasons, it is not always possible for students to gain hands-on experience of certain equipment. The project developed a software simulation of a magnetic balance. Students could add various compounds to the balance and observe the reactions. The software also checked the student's calculations and offered help. A second piece of software enabled students to study complex chemical compounds. Tutors can create their own molecules for students to observe. The system also provided text information about other structures.

Hypermedia Demonstrators

The timetable for this group was as follows:

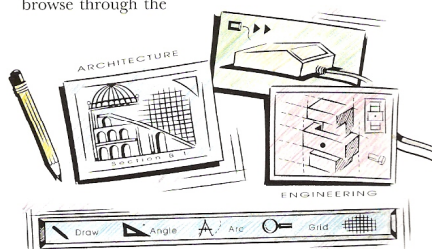
1-3 months	Planning and Research
4-7 months	Development of prototype
8-12 months	Evaluation
13-17 months	Refinement and final testing
18 months	Final reports

USHIR (University of Sheffield Hypermedia Information Resource)

For this project, the group developed a unique 'Knowledge Based Hypermedia System' (KBHS). This combines a powerful problem

solving system, PROLOG, with a friendly browsing system, HYPERCARD. The programming system can process complex information and provides many useful features, such as the ability to answer specific rather than general queries. The resulting hypermedia system is easy to use.

USHIR provides users with information on many aspects of life at Sheffield University. The system contains information on 24 university departments, around 500 staff and includes course details, timetables and maps. The system is flexible and is designed for many types of users. For example, a school student could use USHIR to browse through the



university prospectus, while an undergraduate may use it to plan next year's course. One of the problems with existing information systems is that it is difficult to update information, such as staff changes or course alterations. Input of such information has been made very easy and USHIR's programming system automatically sorts and orders any new data fed into it.

ICAD (Intelligent Computer Aided Design) Tutor

Computers have transformed the field of design. Computer Aided Design allows users to display complex graphics and animations on a computer screen and to perform difficult calculations quickly and easily. But as CAD

becomes more sophisticated, it is increasingly more difficult to cater for an individual student's needs. The ICAD tutor is a Knowledge Based Hypermedia System (KBHS) demonstration system. It is used in conjunction with a standard CAD design package. Students using ICAD can select topics, explore information and ask specific questions. The system has been designed for three types of users - beginner, intermediate and expert - and matches the information to the user's knowledge level. The system also records the student's interactions for monitoring purposes.

Hartlib Papers

Sheffield University Library houses the Hartlib Papers, a unique archive of seventeenth century life. The archive consists of 25,000 pages which include manuscripts, letters, diaries and memoranda. The collection is a rich source of information for researchers and academics, but the sheer size of the collection makes it difficult to search for and find information. Another problem is that a number of the papers are fragile and cannot be physically handled. The project team designed a hypermedia system which, for instance, stored 150 documents on bees and bee keeping. This subject includes papers on history, science, politics, religion and

literature. Users of the Hartlib system can search, browse and explore the varied information which is in the form of transcripts, document images, pictures and engravings.

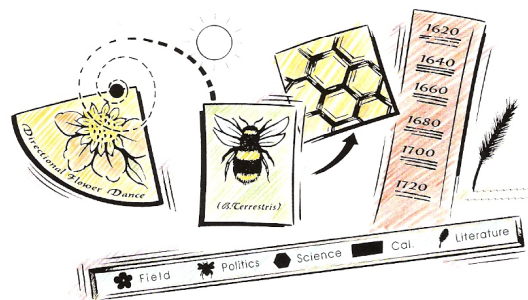
Results

All these projects produced a number of results.

Information Technology and Teacher Training

The research work discovered that:

- Many student teachers have little detailed experience in computing; most work is restricted to word processing.
- A significant number of students are still frightened of computers.
- The different types of computer standards create confusion.
- Computer hardware and software designers need to simplify their products.
- Course tutors require greater exposure and personal access to computers.
- Tutors and student teachers require more resources.
- Suitable technical assistance is significant in developing students' capabilities.
- Any change needs to be planned rather than left unstructured or chaotic.



Statistics

Research showed that:

- The system enabled students to work at their own pace.
- The system offered instant feedback so that errors could be detected quickly and easily.
- Students could obtain on-line help.
- The system was cost-effective.
- The hypermedia system was at least as equally effective as conventional teaching.
- The system was flexible and could be integrated into other statistics courses.

Chemistry

The project revealed that:

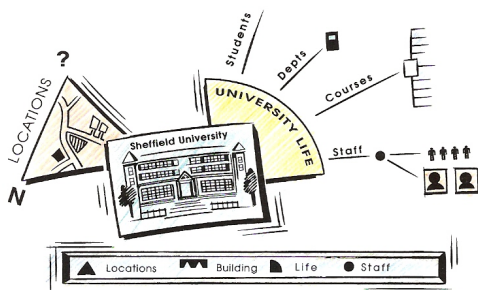
- Hypermedia can sometimes be used in place of practical equipment.
- Students find that it helps them understand concepts.
- It is possible to display chemical formulae in an acceptable format on a computer screen.
- It is possible to analyse complex chemical formulae and so build up details of compounds.
- The system is flexible and allows individual input by the tutor.
- The system can check a student's work and offer help.
- Although further developmental work is required, the system is a useful learning tool.

USHIR

- A Knowledge Based Hypermedia System offers many advantages over conventional hypermedia systems.
- The system is easy to use.
- It is easy to update.
- The system can answer specific queries.
- Users can search or browse.
- The system is flexible and can be used for many other applications.

ICAD

- The system can be tailored for the individual.
- The system is flexible.
- ICAD caters for various knowledge levels.
- The recording system can be used for monitoring progress.
- ICAD offers help and advice.
- The system is cost-effective.
- ICAD is compatible with existing teaching methods and at least as equally effective.
- The system can be used for many other applications.



Hartlib Papers

The project group found that:

- The system provides access to large amounts of information.
- Most people find the system easy to use.
- The system allows users to browse, search and explore.
- Although hypermedia is useful for searching through large amounts of structured material, it is not so good at handling vast amounts of unstructured material.

Conclusions

The project found that Hypermedia:

- Offers active involvement.
- Provides immediate feedback.
- Is compatible with conventional teaching.
- Is more popular than traditional methods of teaching.
- Is at least as effective as conventional teaching.
- Offers flexibility - for example, users can work at their own pace.
- Can match the work to the user's knowledge level or experience.
- Can be stimulating, when properly designed.
- Provides access to large amounts of information.
- Enables information to be found quickly and easily.

However, the project also discovered that:

- Producing hypermedia materials can be an expensive and time consuming process, even when using off-the-shelf authoring packages.
- Hypermedia programming is not easy and requires many human and hardware resources.
- Anyone considering the use of Hypermedia should ensure that they do not 're-invent the wheel' - there are many hypermedia products on the market and these may be suitable for the user's needs.
- Existing hypermedia technology is not suitable for vast amounts of unstructured material.
- Users of hypermedia systems may find the browsing facility disorientating (known as 'becoming lost in hyperspace') and any system needs to ensure that users can easily get back to their original starting place.
- Computer screen design needs to be clear and friendly, with sensible use of colour and graphics.

The Sheffield work has shown that sound research is a pre-requisite for any successful programme. The project's results and conclusions have implications for many groups and interested parties, including computer companies, educationalists and potential users. The work has shown that hypermedia can be a powerful tool for flexible learning, but it has also revealed the limitations of the technology. One of the most exciting project developments is the Knowledge Based Hypermedia System, which seems set to play a major role in flexible learning and many other fields.