9th BILETA Conference
Building Systems

1st & 2nd April 1993
John Moores University
Liverpool

Automating Computer Based Learning Packages For Law Design, Interface And Implementation

Eve Wilson

Keywords: computer based learning - interface design - hypertext - Automatic mapping assessment.

Abstract: Computer Based Learning (CBL) is most effective when packages are designed to accommodate the needs and aptitudes of the learners as well as the goals of the teaching programme. However, design is frequently constrained by cost and the limitations of the implementation environment. A user-oriented computer interface is crucial to a successful CBL program. The interface must be easy to learn and to use, yet it must provide enough variety of task to stimulate the student. In addition, a CBL package can only be truly effective if all exercises can be assessed by the computer to provide learners with immediate feedback about their achievement. Instruction, exercises, evaluation and feedback must be integrated into a single coherent system. Ideally, the system should also provide different learning pathways and instruction sequences for students with different levels of ability. The difficulties of providing such packages are frequently exacerbated because the law teacher is not a computer specialist. What is needed is a mark-up system, or system of templates, so that learning programs designed by a lawyer can be automatically mapped into a hypertext package. This paper discusses the issues involved and describes a prototype mark-up and mapping system.

Introduction

In an ideal learning environment a student has unlimited access to a knowledgeable and gifted teacher without having to compete for attention with other pupils (although these are invaluable for companionship, learning to work co-operatively, to debate and discuss). Nothing is so adept as a sensitive human teacher in interpreting a student's responses, overt or covert; in assessing prior attainment and current need; in providing encouragement and motivation. However, such an ideal environment is as rare as those who enjoy it are fortunate. Most students must usually make do in traditional seminars reinforced by self-study with books. Neither medium is ideal for all purposes, and computer based learning (CBL), while not aspiring to replace either book or teacher, can help overcome the shortcomings of one and the short supply of the other. This paper considers how learning programmes can be translated into hypertext packages for computer assisted legal instruction (CALI) and looks at the merits and defects of the resulting system.

Design Considerations

In the design of any learning programme, with or without a computer, there are three pertinent factors to consider:

i) the learners;

ii) the goal, and the skills that must be taught if the learners are to attain the goal;

iii) the method and environment: how best to realise the programme within the available resources.

The Learners

The target beneficiaries of CBL packages in University Law Schools constitute an unusual group when compared with the undergraduate population as a whole. There is a much higher proportion of postgraduate students, who are taking law as a second degree; of part-time students, who are taking additional courses to further their careers; and of foreign students, who have come from different regions of the world and have diverse cultural traditions and social backgrounds. It is clear that in such a group, the students' initial knowledge of law and latent understanding of English legal practice will vary widely, and that, consequently, they need individual learning programmes.

It is clear, too, that many have already proven competence: sometimes in law, sometimes in other academic disciplines. They are, in educational terms, 'mature learners', even high achievers, and this bears upon the methods that will be acceptable and promote learning. Mature learners will have already acquired considerable knowledge about their own cognitive abilities and are adept at planning and monitoring learning activities (Brown 1977). They have enough prior knowledge to have clear objectives, to appreciate the amount of work they must do to reach the goal they have been set, to pace their progress and to be aware of whether they have achieved an acceptable level of understanding. This means that they are more likely than most students to benefit from a study program that is self-directed or *learner controlled.*

Under learner control, study management is the student's responsibility. Teachers decide the content, and how the content should be structured; they may define one or more preferred paths through the information and set targets for how much an average student might be expected to accomplish in a given time. Thereafter, each student is self-directed and self-paced. In this environment well-motivated, high achieving students make progress more quickly than expected, thus saving themselves much time (Kearsley and Hillelsohn, 1982).

Goals

The main goal of most CBL packages is to improve the students' knowledge of substantive law and legal practice. This means introducing them to the vocabulary, concepts, and working patterns of practising lawyers, then testing to ensure that the student has understood and can actively apply the knowledge. Ideally this might be through law clinics run by the students with professional supervision; in traditional courses this has usually been achieved through seminars and discussion groups. However, as group size increases owing to pressure on resources produced by financial constraints the shortcomings of this environment have been thrown into sharper focus. When a problem is posed to a large group, only one or two people can respond overtly; others may respond covertly, determining the answer even though they cannot give it; others will learn passively by listening to their peers' responses; however, some will learn nothing,. either because the pace of interaction is too fast and their background knowledge inadequate, or because the pace is too slow because it is material with which they are over-familiar.

Nothing can entirely replace human interaction because true comprehension requires the opportunity to ask and answer questions not merely about bare facts, but about their implications in the light of one's knowledge and experience of the world and the human condition. Computers, while more adaptable than books can neither interpret nor reply as freely or creatively as a human teacher who may well respond as much to covert as to overt signals. Every question in a CBL program must be framed so that the computer package can assess all possible answers. This usually limits the students' answers to a word or phrase from a restricted vocabulary. The learner's freedom to pose questions is equally curtailed: frequently, it consists of the ability to request further information from a known

source: direct questions are usually proscribed.

Method and environment

The shortcomings of CBL as an educational environment have been rehearsed all too frequently. However, progress is being made. Especially through hypertext, computers now have the ability to integrate disparate documents (e.g. text books, dictionaries, computer manuals) and to allow the user to navigate freely among them. This increases users' chances of finding the information they need under their own initiative. The, computer can monitor a student's progress with a thoroughness and attention to detail that a human teacher could not begin to emulate. It can suggest paths through the material consequent upon the student's past attainments and suggest exercises of appropriate difficulty: it can repeat lessons, re-order questions, re-present omitted or badly answered questions, and even, in some circumstances, generate new questions. CBL programs are reusable; colour, graphics, even animation are available where appropriate. If so programmed they can present the material in a variety of forms and many different orders; they can select exercises graded for the current attainment level of the student and devise new ones. They can be programmed not to let the student cheat by looking at the answer before he has seen the question. They can monitor the student's progress and give feedback on level of performance, in absolute terms or in relation to the peer group. For presenting additional information in tutorial sessions, to correct mistakes or to extend the knowledge base, they are more flexible and imaginative than a book although less so than a teacher.

Factors Affecting Interface Design

- Easy to learn and remember

Students who are studying law already have complex problems, which demand all their attention. The interface should be simple: the computer's capabilities should be exploited appropriately rather than fully. To this end, a simple menu system, rather than a complex scheme involving expansion, contraction and scrolling, is often the preferred method of navigation through a package. Most students seem to find this natural and adapt quickly. By contrast, some students find the scroll-bar mechanism alien. Therefore, even if the hypertext system used to implement a CBL package has scrolling capabilities it may be better to reduce displays to single screen whenever possible.

- Easy and efficient to use

Using a CBL package should require no manual dexterity. Many students do not type quickly or accurately. Searching the keyboard for the character they need, correcting typing mistakes, resubmitting answers judged wrong because they were misspelled wastes time that could be spent more profitably on more intellectually rewarding activities. Pointing and selecting with a mouse is quick and easy; even students who have never used a mouse before can acquire adequate skill in five minutes.

- Fast and consistent response

Speed of response is a critical criterion for determining user acceptability. Students are less patient with a computer package than with a human teacher, perhaps because they cannot watch it think! Any response time greater than two seconds should be acknowledged with a message assuring the student that the computer is busy. Most responses should seem instantaneous to the user, and it should always be consistent. For example, in hypertext every selection of a link button or icon induces a response. This mimics more closely the innate response of a human teacher and contrasts with many CBL packages, where the student must signal that the response is complete before the computer will acknowledge it. In yet other packages, different exercises are implemented inconsistently, so that the effect of a function key may vary with the task, or different function keys

may be used in different tasks to produce the same outcome.

- Clarity and user control

An untidy and cluttered screen can be as distracting as an untidy desk. To this end, CBL packages are better implemented in hypertext systems where the maximum number of relevant windows open at any one time can be restricted. Two windows plus, perhaps, a pull down menu are usually adequate: multiple overlapping windows are not conducive to learning; nor is the egocentric exploitation of all available display technology by the system designers. Too often, CBL implementors over-familiar with hypertext and computer conventions ignore the inexperience of their users. Help should be available at all levels.

i) at the system level:

How to start, how to use any peripherals such as the mouse, how to leave.

ii) at the package level:

Help to understand the goal of the package and its structure, how to navigate through the structure, how to leave the package (many CBL packages seem determined to detain a user until the end of a prescribed sequence.)

iii) at the task level:

Help to understand the aim of each exercise, how to complete it, how to get help.

Selection Exercises

Advantages and disadvantages

It cannot be denied that, in essence, all exercises that use only pointing and selecting techniques are multiple choice questions that rely on the student recognising and selecting the right answer. This has disadvantages:

i) Selection does not allow students to think of an answer independently and express it in their own words: it never tests recall, only recognition.

ii) Some exercises require distractors to stand alongside the correct answer: sometimes it is difficult to find enough plausible distractors.

iii) Seeing plausible but wrong answers may be detrimental to learning (Skinner 61).

iv) Too little variation in method could lead to student boredom.

There are also advantages:

i) the student can enter an answer quickly and easily.

ii) the answer can be checked quickly and easily. This is important: nothing causes a student greater frustration than an answer wrongly judged. An answer might be rejected simply because it does not match exactly any of the answers to that question stored in the machine. Even experienced CBL designers find it difficult to write more 'forgiving' packages, especially if the answer is longer than a single word and can genuinely be expressed in a variety of forms.

Modes of interaction

To counteract dullness by introducing novelty of appearance, designers of selection exercises in traditional printed books have invested much creativity in dressing basic multiple choice questions in a variety of guises. The formats for the exercises may be divided into five categories:

- Boolean questions
- Traditional multiple choice
- Mix and match
- Cloze exercises
- Connectivity matrices

i) Boolean questions

A simple boolean comprehension exercise is shown in figure 1.

Is section 2(1) of the Unfair Contract Terms Act subject to the reasonableness Test?

       Yes   No

Figure 1: Boolean questions to test comprehension

ii) Traditional multiple choice

In traditional multiple choice questions, the student has to select the right answer from a list of more or less plausible distractors, see figure 2. Some teachers feel that suggesting wrong solutions misleads and confuses students: this is a pedagogical issue that ought to be addressed.

Which of the following sections of the *Sale of Goods Act 1979* requires that the word-processing software be of merchantable quality?

section 12(1)

section 13(1)

section 14(2)

section 15(2)

What type of term is implied by section 14(2)?

       Condition   Warranty   Innominate

Figure 2: Multiple choice

iii) Mix and match

Here the right answer to a question is concealed among the answers to all the other questions in the exercise. Students have to match the answer to the question by choosing a question and then selecting the answer. The exercise becomes easier as possible answers are eliminated, see figure 3

LEGAL TERM   MEANING

1. affidavit   A. deprive a judicial proceeding of its operation

2. affinity   B. fighting of two or more persons in a public place

3. affray   C. kinsmens related through males

4. agnates   D. manufacturer's union to keep up prices

5. alba finna   E. power of the owner to dispose of his interest in property

6. alienation   F. quit rent payable in silver

7. ambulatory   G. relationship by marriage

8. annul   H. revocable for the time being

9. barratry   L. statement voluntarily signed and sworn to or affirmed

10. battery   J. strinking another person in a rude or angry manner

11. cartel   K. wrongful act wilfully committed by the master or crew of a ship

Figure 3: Match the meaning to the expression

iv) Cloze exercises

A Cloze exercise with a master list of phrases is similar to mix and match except that context is always given, and phrases can be used more than once or may not be used at all. Students can have second thoughts about any answer by selecting the wrong word button and then selecting the answer they want to delete.

Use the following phrases to complete the passage below:

absolute discretion	Executors and Trustees
Administration of Estates	GIVE
APPOINT	loss and after payment
capital gains tax and legacies	Residuary Estate
capital gains tax or other taxes	testementary dispositions
codicil	Trustees Upon Trust
death or other duties	Trustees
DEVISE AND BEQUEATH	Will

I *John Smith* in the County of *Kent* HEREBY REVOKE all __ heretofore made by me and DECLARE this to be my last Will. I __ *Joe Bloggs and Sam Brown* to the __ of this my Will and they or the survivor of them or other the Trustees for the time being hereof are hereinafter called "my Trustees". I __ to *Jane Doe* absolutely and free of all __ and free of __ all my personal chattels as defined in Section 55(i) (x) of the __ Act 1925 not otherwise hereby or by specifically disposed of I - all my real and the residue of my personal estate and effects of which I have power to dispose by __ whatsoever and wheresoever unto my to sell call in and convert the same into money with my powers to postpone the sale calling in and conversation thereof and to retain any part of my estate in its form of investment existing at my death for so long in each case as my - shall in their __ think fit without being liable for __ thereout of my debts and funeral testamentary expenses (including _) to invest the residue of such monies and my ready money in their names in any of the investments hereinafter authorised and to stand possessed of such investments and of all parts of my estate for the time being unsold (hereinafter called "my ")

Figure 4: Cloze exercise with a master list of phrases

v) Connectivity matrices

This is another form of comprehension exercise. This time the student is shown two lists of key words or phrases and asked to indicate where there are connections or associations between them.

	Adams and another v Riley [199	Attorney Generey G enc er al v Ob ee rv er L t	Flack v Baldry [1988] l Al [ER 6	R v M al v J us ti ce s ex p ar t e t c	R v Sharp [1988] ER 65	R v Spring Hill P ri so n G ov er no r	Re K. Re F [1988] P ri so n A l E R 35	Rowling and F [1988] R 358 P	TCB Ltd v Gray [1987] A ft or A l E R	United Bank Ltd v M an ja r a nd o
Contempt of Court										
Constitutional law										
Contract										
Costs										
Criminal evidence										
Extradition										
Firearms										
Legal aid										
Libel and slander										
Negligence										
Power of attorney										
Probate										
Variation of trusts										
Ward of court										

Figure 5: Connectivity Matrix

Automating Cbl Packages

The Document Type Declaration

The object in analysing the format types so closely is to be able to describe formally each exercise type. Any formal methodology would suffice but ideally the description should be independent of software and hardware so that the material is portable. Since it will be used by teachers not necessarily familiar with logical description it should be easy to use for simple tasks. The tool used here is the Standardised General Mark-up Language (SGML). SGML is a language for describing markup independent of application. Mark-up is information which is added to the content of a document to identify its structural components. It may also explain how to interpret or process the content, but it should always be descriptive rather than procedural. In SGML the structural components of a test are called elements. An element is delimited by a start-tag *<tag>* and an end-tag <Itag>. It may contain data, elements, a mixture of both or nothing, i.e. it may mark a point without content. Since most document structures are hierarchical, elements are usually nested, and occasionally recursive. The hierarchy of elements, the rules about how they combine, and their content declarations are expressed in a Document Type Declaration (DTD). The DTD for a simplified CEL exercise is shown in figure 6.

```
<!DOCTYPE calset

<!ELEMENT calset                        - - (title,preamble?, exercise+, result?)>
<!ELEMENT exercise                      -0 ((subtitle,preamble?,form+)+)>
<!ELEMENT preamble                      -0 (instruct?,help?,re~itext?)>
<!ELEMENT form                          -0 (preamble?,(booleanlmultiplelmixmatchlcloze)+)>
<!ELEMENT boolean                       -0 (((truelfalse),postqust?)+)>
<IELEMENT postqust                      -0 (explain?, further?)>
<!ELEMENT multiple                       -0 ((quest,(distract+ &answer),distract*,postqust?)+)>
<!ELEMENT mixmatch                       -0 (pair+,postqust?)>
<!ELEMENT pair                          -0 (term,meaning+,postqust?)>
<lELEMENT doze                          -0 (((contextlreplace)+,postqust?)+)>
<!ELEMENT (titlelsubtitle)               -0 (#PCDATA)>
<!ELEMENT(instructlhelplref)            -0 (#PCDATA)>
<!ELEMENT(lexplainlfurtherltext)         -0 (#PCDATA)>
<!ELEMENT(truelfalse)                   -0 (#PCDATA)>
<!ELEMENT(questldistractlanswer)        -0 (#PCDATA)>
<!ELEMENT(termlmeaninglcontextlreplace) -0 (#PCDATA?>
<!ELEMENT result                        -0 (#PCDATA)>
1>
```

Figure 6: Simplified DTD for a CBL package in law

Notice that in the rules of the DTA elements may be separated by, and or |

, means that the elements form a sequence i.e. they occur in the order specified.
& means that the elements are an aggregate i.e. they may occur in any order.
| means that the elements offer a choice i.e. only one element may occur.

Within the ordering specified by the rules, an element may be

required i.e. it occurs exactly once. This is the default.
optional i.e. it may be absent; if it is present will occur only once. An optional element is denoted by?
repeatable i.e. it must occur once, but may be repeated any number of times. A

repeatable element is denoted by +
optional and repeatable: i.e. it may be absent, occur once, or occur any number of times. An optional, repeatable element is denoted by *.

A document instance

In use, the DTD must be followed by a document instance, i.e. by the text of the document with the tags inserted. Descriptions of the major elements that the teacher must supply are as follows:

In *calset:*.

title: title for the CBL package.

In *exercise*:

subtitle: title for set of exercises. It will appear in the main menu of the program which serves as the contents page of the CBL package.

In *preamble:*

instruct: the instructions that the student will be given before commencing the package, subset of exercises, or question.

help: advice to the student on how to tackle package, subset of exercises, or question.

references: lists the source materials that the student might consult before attempting the package, exercise set or question.

text the reading material on which the package, exercise set or question is based. It may be a narrative, a statute, a law report.

In *postqust*

explain: gives the correct answer and an explanation to the student who answered wrongly.

further: additional information that the teacher wants all students to read. An example of a short CBL exercise marked-up as required by the DTD in figure 6 is shown in figure 7.

> <calset<title>CALIGUIDE <exercise> <subtitle>Contract Law <form>
> <preamble> <ref>Liverpool City Council V. Irwin [1976] 2 All ER 39.
> <text>In a contract for the purchase of 'off-the-peg' accounts software, the
> sellers, Hype Software gave the purchasers, Small Solicitors, a 'warranty'
> that the software will work in the MacTavish microcomputer that Smalls
> already own. <multiple> <quest>What type of contract is contained in this
> sentence? <distract>Supply of services <answer>Sale of goods
> <distract>Insurance <distract>Hire <postqust <explain>A contract
> whereby a seller transfers ownership in goods to a buyer or purchaser in
> return for money (the 'price') is classified as a sale of goods contract.
> <boolean> <true>Will a term as to the software's quality be implied into the
> contract? <Icalset>

Figure 7: Document instance for the DTD specified in Figure 6.

The exercise can be converted into source code for the Guide hypertext system running under Unix.

Merits And Defects Implementation

The method of formal specification means that

1. Any competent lawyer, whether computer literate or not can produce a CBL exercise.
2. The exercise can be mapped into any hypertext system for which the source codes are available. It is not restructured to proprietary software or hardware.
3. Consequently, it can be easily transposed and easily extended, amended or updated to use the needs of specific courses and individual teachers. It is easily linked to other source documents in the same hypertext form. For a description of legal source texts integrated by hypertext (Wilson, 1988).

Interface

Initial trials have confirmed that an interface design that uses only a mouse is acceptable to users of CBL packages; they find it simple and pleasant to use. The trials have paved the way to converting automatically texts and exercises that already exist in appropriately marked-up electronic forms into hypertext versions that will be more acceptable to users than printed forms. Automatic conversion has proved a worthwhile venture in information retrieval with large, integrated databases, (Wilson, 1988). Hypertext makes browsing more beguiling and improves the chances of learning by serendipity.

However, learning by serendipity, or incidental learning, has not yet been proved to be an efficient, or even an adequate, philosophy of education. While learning that is entirely self-directed can be justified for well-motivated students with considerable prior knowledge, more guidance should be available to students who need or desire it.

There are several obvious ways of giving such guidance. For example, it should be possible to suggest paths through the exercises that are appropriate to a student's prior competence: tutorials and exercises that cover skills in which the student is known to be weak might be presented first, before tiredness sets in; extra exercises might be recommended; badly done exercises from previous sessions might be presented again. To do this, the system must be able:

i) To assess prior knowledge.

ii) To use the assessment to determine what needs to be taught and the order in which it should be taught.

iii) To monitor progress during a tutorial session.

iv) To test at the end of a sequence of tutorial sessions to determine what progress has been made by the student and to measure the efficacy of the hypertext system as a teaching tool.

v) To provide better feedback to the students. Most students want to measure their

progress against recognised standards, or against their peer group: knowledge of how they performed on an isolated set of exercises is not enough.

It is easier to foster comprehension skills than it is to promote analysis from first principles and the creation of original arguments that are well-constructed and eruditely expressed. While free conversation between computer and student remains a pipe-dream, the tools required to furnish an effective document draffing environment exist: electronic dictionaries, thesauri, spelling checkers, programs to assess vocabulary and style, packages to generate concordances for checking word-collocations and word usage in context. The goal is to integrate all these into a complete workstation for law students.

Bibliography

Brown, A. L. (1977). 'Development, schooling, and the acquisition of knowledge about knowledge', in *Schooling and the acquisition of knowledge,* 241-253, edited by R. C Anderson *et al.,,* Lawrence Erbaum Associates, Hillsdale, NJ.

Kearsley, G. P. and M. J. HlIIeIsohn (1982). 'Human factors considerations for computer-based training', *Journal of Computer-based lnstruction,* 8(4),74-84.

Skinner, B. F. (1961). 'Teaching machines', *Scientific American,* November, 3-13.

Wilson, E. (1988). 'Integrated Information Retrieval for Law in a Hypertext Environment', 7 *Proceedings of the ACM SIGIR 11th. International Conference on Research and Development in Information Retrieval,* Grenoble 663-677.