1. **Introduction**

We have known for a long time that different subject matters of education require different learning strategies. A classroom drill which may be useful for learning one subject may not work with another subject which, for example, might make better use of a role-playing exercise, a simulation or a discussion. The principle turns out to be even more important as we move to wider and wider uses of technology in education. For computerized learning is very specifically tailored to a given learning situation and incorporates a specific pedagogical design. In some ways, it is less flexible than the classroom teacher who can, for example, convert a drill into a discussion when the need appears. It is thus of special importance in developing computer-assisted learning strategies that one clearly identify the particular subject of instruction and that one develop pedagogies suitable to that subject.

In making this identification, there are some field-specific features that warrant special attention. For example, while the field of law presents an enormous variety of things to learn, most are marked by a central characteristic: law is a not only a highly verbal discipline, it is verbal in a very special sense. Law uses words not merely to convey information, but to command, to exhort, to persuade, to inquire, to express delicate compromise, etc. Words are used in law as a means both of engaging in and communicating the results of the process of principled dispute resolution. In terms of breadth of use, there is a sense in which the law’s use of words is more like that of the poet than that of the journalist.

Today’s technology presents some remarkable opportunities for a verbally rich activity such as law. Compared to the pages of a book, the computer screen has some serious limits in terms of portability and graphic resolution. But where these are not critical factors, the computer has some special qualities the book does not have. One special feature of the com-
puter's «page» is its instant expandability. If one thinks of the page of a book as a picture to look at and think about, the computer screen is a window through which the user can go to immediately explore other topics.

This essay describes three examples of computer-assisted learning in law that have attempted to make some use of this expandability. The first uses a version of so-called hypertext to effectively deepen the screen, permitting access to multiple layers of information at the choice of the reader. The second suggests some screen design principles that permit very substantial enrichment of the screen. The third suggests the value of added media to augment the visible screen. None of the three can be fully portrayed on the printed page of this journal, which, of course, is why the new technology makes them so exciting. But with the aid of a few illustrations, the rough ideas may be suggested.

It should be stressed that the considerations here discussed are preliminary – this medium is far too young for anyone to be more than provisional about any conclusions or advice. But it is important that those engaged in these early adventures share their experiences with others in order to begin cumulating what we do know. In that spirit, readers are encouraged to communicate with the author. Agreements, disagreements new application and thoughts are all most welcome.

2. Using Hypertext to Deepen the Screen

There is a special sense in which hypertext is useful in exploring legal materials. Law is an authority-based set of rules. Hence, the controlling influence of any legal proposition rests on the authority from which it issues. The ability of hypertext to permit instant examination of the authority behind a proposition makes it especially suitable for legal discussion. Far more complete and more flexible than the footnote or parenthetical statement, hypertext legal discourse seems likely to be very widely used in the future.

Hypertext is used in the first example here – part of the instruction in the so-called «dormant commerce clause» in US constitutional law. The doctrine is especially vague, not only because of its complexity and subtlety, but because it is a doctrine rooted in negative implications: the doctrine describes limits on the power of states to regulate interstate commerce which flow essentially from the fact that the national congress has said nothing about the matter.
The doctrine is almost wholly court-constructed and the result is a series of decisions (frequently with dissenting and concurring opinions) of unusual opacity. Students often have trouble finding the pattern in these cases and clarifying the relationship between the various branches of the doctrine. Law study in the US is intended to leave students on their own with problems of this sort in the belief that the process of finding (or creating) a pattern is important skill-building. But now and then some assistance is needed and the dormant commerce clause seems to this writer one of those cases.

The first task, then, is to design a concept map on which all the principal components of the doctrine can be related. Fig. 1 shows such map.

![Diagram of dormant commerce clause](image)

It is in the form of an algorithm identifying the questions that need to be answered in determining whether a state law — challenged under the commerce clause — is valid.

The first exploitation of the computer screen’s special quality lies in the manner in which this algorithm is presented. Unlike the printed version shown in Fig. 1 — which confronts the reader with the entire scheme at once — the computer presentation is built up one question at a time. The speed of development is controlled by the user, who can reflect on what
is present on the screen, consider what has been added by the last increment without the potential confusion of having the rest of the map visible.

The second way in which the computer’s special qualities are used is in the careful use of color. All of the question boxes are in the same distinctive color, all of the «yes» and «no» boxes are in a different distinctive color, and all of the other text boxes (including some navigation buttons not shown in Fig. 1) are in different colors. Graphic design principles suggest that these different color groupings present useful navigational an orientation information to users which is not contained in the typical black and white printed page.

The third – and in some ways the most distinctive – use of the computer’s special capacity is the use of so-called hypertext. At any time during the development of the algorithm the user can «click» on one of the question boxes and be move to a screen with more information about that question. The text develops important background information about the question, indicates something about its importance, suggests some patterns found in judicial answers.

In addition, these auxiliary screens present examples, case citations or reference materials. In the latter two situations, the case names themselves (or the reference citations) may be hypertext buttons which will permit the user to review excerpts (indeed, the full text) of the cases or references. And, of course, each of the matters so viewed may have additional hypertext buttons for further exploration.

As will be apparent, a considerable body of material can be included in the program with this method – if storage capacity is adequate, a book-length treatment of the subject is feasible. Accessing the material, however, is quite different from one’s approach to a book. In effect, the original concept map becomes an Index to a book whose paragraphs and pages are nested in a series of hypertext loops. The reader is invited to look up what is important at the moment and to explore it at whatever depth seems useful at the time. It is the user, not the author, who effectively determines the structure.

One of the shortcomings of the hypertext approach to large bodies of text is the problem of user-orientation. As a user gets more than a level or two from where he started, one’s sense of «where I came in» gets dim. The printed book uses chapter and section titles, page numbers and running heads to keep the reader informed about where he is. Moreover, the book has physical properties which transmit orientation information to the user (holding a book, one can tell even with one’s eyes shut, whether one is nearer the beginning than the end of the book).
Some of these clues can be approximated in the hypertext computer version. Screen titles can be carefully written to convey useful orientation information. For example, at the cost of only a few lines of screen space, the title line from previous screens in any hypertext loop could be left visible on the screen so the user can always see the path he has followed (see Fig. 2).

**FIG. 2**

<table>
<thead>
<tr>
<th>Title of the first hypertext reference.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title of the second hypertext reference.</td>
</tr>
<tr>
<td>Title of the reference the user is now reading.</td>
</tr>
<tr>
<td>..........................................................</td>
</tr>
<tr>
<td>..........................................................</td>
</tr>
</tbody>
</table>

Page numbering can also help, especially if it is of the «page 23 of 67» sort. Color can also help with orientation: with deeper hypertext penetration, e.g., screen colors can take a consistent shift from one palette to another. And sometimes, submaps can be used to show a user where he is in a particular loop.

3. **ScrFFN Design Principles to Enrich the Screen**

It is clear to most observers that the screen is the weak link in the presentation of material via computer. While input devices and processing units today have incredible capacity, speed and portability, it remains that the output of the computer must be funneled through a screen which is vastly inferior in resolution to the humble printed page.

The usual response to this difficulty is to simplify: to put fewer objects on the screen and to reduce the complexity of objects. This may work well for the relatively simple message where an electronic flip chart with three or four «bulleted» items are sufficient. But for more difficult intellectual material, simplification may defeat the purpose. The question then becomes: Can screens be designed with sufficient complexity to carry the intended analysis without becoming difficult for the user to manage?

Frankly, the verdict is still out. Until screen resolution is greatly improved, there will be a shortfall here. But a couple of things are possible to reduce the difficulty. They key on the central idea that what one seeks to
eliminate is not complexity but clutter. That is, for difficult material intended for serious students, one needn’t be limited to three or four items on a screen. Considerably more complex screens can be designed, but preventing such screens from becoming confusing and difficult to comprehend requires that all unhelpful elements on the screen (what I call clutter) be carefully identified and rigorously eliminated.

What is clutter? I think anything on the page that does not have an affirmative pedagogical justification is clutter. I think we should adopt a principle that the designer should «waste no pixels.» Every mark on the screen should contribute. Look hard at each border, each decorative element, each picture or illustration. Look at each exotic screen wipe, each use saturated color, each fancy font. Look at the shadows on boxes. Are you certain that every pixel used in creating these effects can be justified on pedagogical grounds?

In Figures 3, 4, 5 and 6, you see screens that would seem to violate conventional rules about keeping screens simple. If the reader of this article could see these screens as presented, however, they would not be hard to follow. Consider the following hints.

a. **Build complexity slowly with attention to maintaining user orientation.** As we saw in the commerce clause algorithm in Fig. 1, complexity can be
built in slow increments. In Fig. 3, the text on the left is presented first, with essentially a blank screen on the right. Then one by one, the bars on the graph are presented, each with its explanatory labels and each followed by the appearance of a text box describing an example. The user controls the speed of this development and needn’t progress to the next step until satisfied that he understands all that is presently on the screen.

Fig. 4 shows how far this incremental process can be carried without loss of comprehension. Text can be added to a screen which overlaps and obscures other text so long as the user controls the timing of the overlap (the program does not move on until the user clicks the right arrow), and has it within his power to restore the obscured text (by clicking the left arrow).

**FIG. 4**

To assist with orientation, it is important that the location of overlapping material be carefully planned. The user should be aware of exactly what is being obscured by the newly added text. This is largely accomplished in these examples by partial rather than complete overlapping; the reader can still see the edges of the text field that is obscured by the newly added text.

Further, the basic core of the message should not be obscured. In Fig. 4, e.g., the text in the upper left hand corner which states the question to
be examined is left visible throughout the entire series of screens. So, also, the basic chart with its bars and their explanatory labels are never obscured. Figures 5 and 6 show another example.

**Fig. 5**

![Diagram of Agency Decisionmaking Models](image)

B. THREE MODELS OF AGENCY DECISIONMAKING

Fig. 5 has itself been slowly built, box by box, with examples and discussion. When the additional material in Fig. 6 is presented, some of the Fig. 5 material is obscured. But by not changing the basic screen design – i.e., the «mixed» model being discussed in Fig. 6 is not changed in color or position from what was shown in Fig. 5. Moreover, leaving some parts of the Fig. 5 material visible on Fig. 6 also aids the user’s orientation.

b. **Eliminate barriers so the eye can move comfortably over the screen.** While the screens shown in Figures 3 and 4 are divided into distinct segments, this is mainly done by color shifts, not by the use of lines, borders, frames or other barriers. Borders are used only for special illustrations (e.g., the bar graph), for temporary text boxes which will disappear as the program progresses or to identify specific objects being discussed (as in Figures 5 and 6).

c. **Unify the screen by simplifying shapes.** In the screens depicted here, the number of types of visual elements has been kept low and the result
is a more unified screen. While a unified screen might be made up of circular shapes, or of triangular shapes, screen unity is aided by not mixing types unless there is a special reason to do so. The screens shown here happen to be made up essentially of rectangles – there are few circles, no triangles, irregular shapes. Even the lines on the page are almost entirely horizontal and vertical, the sole exceptions being the occasional diagonal connecting lines which – being navigational not substantive – should be different from the other lines on the screen. Not only does this simplification add unity to the screen, it permits emphasis when it is desired. Note how the circle marked «A» in Fig. 6 is given emphasis by its shape and value.

d. Simplify the use of fonts. One font is used throughout these screens, with only an occasional use of italics for emphasis. There will sometimes be screens on which changes in fonts help the user distinguish separate elements of the message, and there is nothing wrong with that. Just be sure every variation you use can be justified by a specific pedagogical objective.

e. Color, like decorations and fonts, should only be used to aid or enrich the communication process. These screens use very few saturated (rich) colors; the palette is almost entirely pastel. This is more comfortable to the user, seems appropriate to the type of serious material being presented and,
importantly, permits the use of occasional touches of saturated color for emphasis or focus. (The circle marked «A» on Fig. 6 is red, while the rest of the screen is soft blues and grays.)

In sum, despite the counsel of those who design screens for simpler uses, it would seem that rich screens can be presented to serious students. The need is to understand the critical difference between richness and clutter, and to be aware that the path to the former is by rigorous elimination of the latter.

4. Multimedia to Augment the Screen

Finally, a brief word about the possibilities of moving beyond simple text and static diagrams. The advent of more and more sophisticated equipment and software means that it is becoming almost daily more feasible to consider adding sound, moving pictures, animations, etc. to our programs. The learning from cognitive psychology seems to be that the more of a student’s senses on can engage in transmitting educational material, the deeper and more durably the material is obtained and the more easily it is retrieved. Of course, most of this research has been done on a younger age groups and there is some doubt that the findings can be transferred wholly into the professional school context. But there is enough evidence to make the experiment plausible and as cheaper and faster techniques become available, so-called «multimedia» will no doubt be explored in legal education.

As the reader might anticipate from the somewhat cautious approach suggested in this article so far, I would urge that any such explorations be made only where the media enhancements can be justified by plausible pedagogical goals.

My own beginning experiments will be only be briefly noted, in part because they are relatively minor and in part because they are even harder to illustrate on a printed page than what has been discussed so far. On the screens depicted in Figures 3 and 4, the reader will note a button labelled «Audio Notes.» The user who clicks on these buttons will see a picture of the author and hear a commentary on the screen being viewed. The comments are short, none runs more than 60 seconds, and attempt to highlight features shown on the screen, explain relationships depicted, identify examples, suggest questions.

The pedagogical justification for this use of audio is straightforward and is in two parts. First, the ear is quite a different receptor from the eye. For one thing, it is not nearly as selective. Thus, a reader may look elsewhere
on the page (or out the window!) when you want his visual attention focussed on a particular piece of text. An audio signal, however, is not so easily avoided by the hearer. True, one can «tune out» of any transmission, but this special quality of an audio signal suggests its use for especially critical or especially important material.

Second, I want to invite the user to consider some implications of the graphic being presented, but I want to do so without requiring the user to take his eyes off the graphic.

In the screen depicted in Figures 3 and 4, the audio note may ask whether there is any significance in the fact that the bars representing constitutional, statutory and regulatory procedural requirements are progressively higher, or whether that is just a caprice of the artist. (The question raises a fundamental issue developed elsewhere in the Administrative Law course that seems usefully recalled here.) I am persuaded that — just as in the use of the blackboard in the live classroom — there is value in seeing the graphic and hearing the question simultaneously. The reader who has had difficulty jumping back and forth from the text references in this article to the various illustrations can perhaps appreciate the value of an audio media enhancement.

The use of a still picture of the author is, of course, inconsistent with this principle. I was persuaded by some who plausibly claim expertise in the area that the voice accompanied by a picture of the speaker was a natural and attention-focussing device. I was able to resist the first version in which the picture was a moving video, but thought we should at least try the still picture. There is nothing in the evaluations I have received which supports or denies the value of the picture. On the presumption here presented that nothing should be added for which there is not an affirmative justification, I think I will not use pictures in future programs of this type.

Of course, there may be many places where still pictures, moving pictures, illustrations, animations, etc. would be essential to the pedagogical goals of a program, in which case I would encourage their use. But tools are not necessarily solutions and the risk of overuse is not just wasted time and resources but the very real possibility that distraction of the user reduces rather than enhances the effectiveness of the entire enterprise.

5. A Final Note on Evaluation

Since all of this is experimental, teachers who use such materials should make an effort to collect evaluations, even when scientific studies cannot be
made. We have precious little evidence about whether or to what extent computer technology alters educational outcomes for the better. Much research is needed (and is being done) and perhaps in 20 years we will have begun to develop some trustworthy studies for use at the professional school level. In the meantime, don’t overlook the value of simply collecting even informal evaluations from the users of your programs. I have found it very helpful to ask users for written reactions, to include technical problems, proof reading errors and substantive difficulties but also, more importantly, more general notions about the value of this sort of thing. I do not get elaborate critiques from all users, of course, but I do get helpful responses which quickly fall into revealing patterns of great use in modifying programs.