

Designing Training Programs for Factory Workers

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ABSTRACT

A typical corporate CBT request is for a program that will be both extremely “user-friendly” and “state-of-the-art”. Within that frame of reference, this presentation focuses on the author’s attempt to design an industrial training ToolBook application that meets these five tests:

1. Usable even by workers with little or no previous computer skills
 2. Effective even for workers with little English reading ability
 3. Modifiable easily by the Training Administrator
 4. Fully self-documenting for record keeping and reporting
 5. Secure enough to hold up under litigation
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PAPER

INTRODUCTION

First, it might be helpful to know the circumstances leading to this paper. My background is an academic one. I am a university professor (in Asian religions and politics) who, perhaps like many of my readers, got involved in multimedia authoring in order to write applications that would help my students better understand, master and review the course material. Or, from their perspective, to help the students better “cram for the exams”.

Having cut my programming teeth on the task of designing multimedia programs for university students, I have, along with a colleague, been asked to author some industrial training programs. At first, the shift from writing for university students to writing for factory workers did not require too big a change in design concepts. The content of the animation simulations was very different, of course. Rather than animating cell division or the expansion of Buddhism across Asia, we had, for example, to animate the “back to back” sequence for operators of a highly automated galvanizing plant.

The bigger challenge was to reproduce realistically on the computer screen the factory’s “control panel”, or rather the various control panels that make up the operating station. Basically, the factory runs itself, but if something goes wrong or a special need arises, the station operator has to take manual control. The operator often must execute a series of settings, in proper sequence, all within less than 30 seconds. Failure to do so will shut down the production line, which can literally cost the company well over a million dollars.

Using Toolbook by Asymetrix Learning Systems, we were able to replicate these instrument panels fairly well, complete with the proper colors, warning beeps, and response tones. It was fun to see the trainees use the program the first time. Their conversations progressed along these lines: “This looks pretty real. Too bad you can’t turn the controls”. “Hey, you can turn the knobs with the mouse”. (laughter when they here the warning buzzer) “This program really works”. “Hey, let’s try to break it!”

Although it was a real challenge to simulate the factory control panel, to get the animations effective and to get the content correct, the interface design did not call for anything radically different than one might use in an academic setting. The operators were mostly graduates of a local college, and we could assume that their level of computer skills and English literacy was high.

SPECIAL DESIGN PROBLEMS

We were approached by a company that does industrial training with the request that we author a CD based program for Lift Truck theory training. The idea was that the

program would replace the current four hour classroom training. The current one hour per driver practical training would continue to be done by live training.

Our client, the training provider, had a long list of expectations. These expectations raised numerous design problems. These problems fell into the following areas:

1. Usable even by workers with little or no previous computer skills
2. Effective even for workers with little English reading ability
3. Modifiable easily by the Training Administrator
4. Fully self-documenting for record keeping and reporting
5. Secure enough to hold up under litigation

This paper deals with some of the specific concerns that arose under each of these headings, and the design solutions generated to meet those concerns.

1. Usable even by workers with little or no previous computer skills

Preliminary market research had indicated that there would be sales resistance to the program based upon the assumption by many training administrators that “the workers out in the plant do not know how to use computers.” This assumption was based mainly upon the difference in the work environment between the office workers who sit at desks and use computers regularly and the factory (or “Plant”) workers, who do not use personal computers, although the factory operation may be highly computerized. My guess is that many of these lift truck operators use computers and play computer games at home, but the training administrator is afraid that many of them do not have computer skills. The prospect of having to train them on how to use a complicated computer program therefore is a serious barrier to sales.

Our attempt at a solution involved these interface design decisions:

Buttons:

- All buttons must be large (“clunky”!) to make it easier for those not used to using a mouse.
- All buttons may be activated by a single keystroke, so that users may access the program without a using a mouse.
- All buttons must have an intuitive icon graphic
- The icon graphics should be consistent and relevant to the program (we chose a set of traffic related icons in keeping with the “driving” theme.

Login:

- Login would be simple (selecting one’s name from a list.)
- Login must be unambiguous, to avoid multiple names for the same person (selecting one’s name from a list.)
- To avoid problems with duplicate names, one’s employee number also appears on the screen.
- Password protection

Help:

- All help is context sensitive
- Help is automatic the first time a user sees a new screen
- Help is available on every screen

2. Effective even for workers with little English reading ability

Our client insisted that there be “**no text**” whatsoever. This requirement arises out of a Canadian context in which factory operators of lift trucks, cranes, punch presses and other such equipment are often immigrants whose mother tongue is not English. The client’s company has been a pioneer in developing training that is effective even for those workers with little to no English literacy, while not insulting the intelligence of those with English reading skills. The design challenge for us was to reproduce this in a computer based program. The requirement to do this without text meant that the so much of what we knew of learning styles and cognitive theory (Maddux, Johnson, Willis; Maddux and Willis) had to be abandoned or modified. Of Marilyn Welsh’s long list of design considerations under the heading “getting to know your audience”, the one she calls “cultural background” was emerging as the most important for us. (Welsh)

Fortunately, the client’s approach to training was one that was “computer friendly”, so to speak. It involved presenting pictures to the trainees, who were then asked to choose the correct picture. In the traditional classroom setting, the trainee uses overheads to project the set of two or three pictures, and then asks which picture shows the correct way to do the task, and why. We had to find a substitute for the give-and-take of a live training session.

We decided upon a three pass instructional design, as follows:

- First Pass: On the **INSTRUCTION** pass, the trainee automatically hears the instruction, views the video and animations for each screen. The trainee may select the relevant button to repeat the instruction. If the trainee answers incorrectly, they automatically hear/see the instruction again.
- Second Pass: On the **Practice Test** pass the trainee does not automatically hear/see the instruction, but may access it at any time by selecting a button.
- Third Pass: On the **FINAL TEST** pass the trainee does not have the instruction available and does not know whether or not the response is correct.

3. modifiable easily by the Training Administrator or Trainer

There were numerous complicating factors. One was that the operators must, by law, be trained on certain regulations. And those regulations might vary from province to province, state to state, or by country.

Another complication was some companies have propane trucks, but those who do not might not want to waste time on regulations about propane handling and refueling. Some companies might not want their drivers trained on lifting people because they might have a strict rule against doing that in the first place. Other companies might have no need for training on docks or ramps, and so forth.

At first this seemed easy. We just modularize the training and let the user pick the relevant ones. But we cannot allow the trainees to make this choice. (They might choose to skip “Lifting People”, then lift a maintenance worker anyway and cause an accident.). So, we set the program so that the System Administrator may deactivate any of the modules not relevant. However, the tracking system must record that!

Our client liked that approach, but insisted that individual screens (sets of pictures) could be omitted by the Training Administrator as well. To avoid any misunderstanding on the Administrator’s part about what she or he was really omitting, an interface was developed in which the administrator made the decision while viewing the screen itself, rather than choosing from a list of screen numbers or topics.

The Program Administrator may also change the maximum number of attempts each trainee may have to complete the program. And the Administrator may lower the percentage needed to pass the final test.

Also, the client wanted the Training Administrator to be able to mark screens with a symbol that means “required”, by law or by company policy. So our design has this symbol appear on certain screens by default, but the symbol may be deleted or deleted to any screen.

4. Fully self-documenting for record keeping and reporting

The program required a much more robust tracking system than is built into most training programs or Toolbook’s CMS widgets. The reason for this is that if an accident should occur, it is necessary to determine whether or not the driver was trained on the particular matter(s) relevant to the incident. A driver might claim “I was never taught that!” In traditional, instructor based training it is hard for a company to prove that the driver was in fact taught a particular safety concern. Maybe the instructor got interrupted and forgot to cover that particular content? One of the important advantages of computer based training in the industrial setting is that it is possible to track exactly what was or was not taught.

So, our design tracks all of the following for each trainee:

- Date and time each module was started
- Date and time each module was finished (or aborted)
- Screens answered correctly during instruction, practice test and final test
- Screens answered incorrectly during instruction, practice test and final test
- Version number of the program

The Training Administrator also needs to know the progress and status of the trainees. So, we designed a number of reports:

- Summary Report on all trainees
- Summary Report of a subset of all trainees
- Full Report on individual trainee
- Statistical Report on percent trained, untrained, in progress, etc.

When they complete the training, the program prints a certificate in wallet size, full size, or both.

Some companies may want the data exported to a company database, so we built in an export function.

5. Secure enough to hold up under litigation

A final concern was that the reports generated by the program be usable in any court case that might arise from an incident involving a trainee. The main concerns here, and the solutions, are as follows:

Could the trainee have skipped one module? Solution: trainee's may not take the practice or final tests unless all (activated) modules have been completed.

Was the driver really instructed on this matter? Solution: the trainee must hear the sound files and see the animations during the instructional pass.

Did the driver really understand what was being taught, or perhaps just guess correctly? Solution: the trainee must correctly answer the question on all three passes.

Was the driver trained on an earlier version that did not have this screen? Solution: The training record includes the version number.

Did the driver know this is really important? Solution: The "required" icon appears on especially important screens,

Could the training administrator, driver or some other official at the company have tampered with the training record? Solution: the training database is not alterable.

Could the trainee have skipped one module? Solution: trainee's may not take the practice or final tests unless all (activated) modules have been completed.

Did the trainee have difficulty in learning the material? Solution: the program evaluates the "degree of difficulty" experienced by each trainee. It factors in the total elapsed time taken, the scores and the number of repeated modules.

Conclusion:

The design of computer based training programs for factory workers requires careful attention to the these among other factors:

- language skill level of the trainees
- computer skill level of the trainees
- the varying equipment and environment of the factory
- the applicable legal regulations, union practices, etc.
- the need for complete training documentation
- the need for a full, printable report on a trainee's training

In this project we did not feel that any special design considerations were required with regard to age, gender or cultural background (other than English language literacy), but in other projects such factors might be important.

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