Optimal Method for Rapid Development of Training Materials Covering Online Software

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Abstract: This paper describes the literature search effort instituted by small group of university academic and staff personnel assigned to assume software training responsibilities for 2,400 university faculty and 1,200 staff and the resulting training materials products and processes developed internally based on the literature search to meet these needs. The result of the effort has been extremely successful and is fully documented, described and illustrated. The training material content, aimed at identifying learner outcomes in terms of work product completion rather than software feature exposure, and the rapid method for design and development of training materials lends itself to productive collaboration and work-sharing among training staff and a high degree of consistency of result. Further research explorations focused on this method and its products are identified.

Introduction

The replacement of a software system with an upgraded version, the installation of new software into a working environment, and the training of instructors and students to use software they have not previously used has become such a common process that it can readily be viewed as a fact of modern life. Two cases suffice to illustrate this point. Tens of millions of computer users are finding it necessary to "re-learn" much of what they know of personal productivity software by the changes imposed by Microsoft's massive redesign of its office suite from prior versions to Office 2007. The new software version, released in November 2006, was downloaded by 3.5 million users for the beta test (Microsoft, 2006) and the changes affect tens of millions of people. In another area, instructors are finding it necessary to learn significantly new software operations as they move from earlier versions of Blackboard's Course/Learning Management System (C/LMS) to it version 8 which has radically changed grading and discussion board components (Blackboard, 2008). Since Blackboard commands the major share of C/LMS installations, numbering well over 3,000, this change affects 300,000 to perhaps one million instructors.

Instructional Technology Development, a unit of DePaul University's Information Services Division, was given the responsibility in 2006 to consolidate a unit of trainers and technical support personnel to accomplish software upgrade training for 3,600 employees, comprising 2,400 faculty and 1,200 administrative staff. In order to accomplish this as effectively as possible the unit was formed with experienced trainers as well as faculty actively engaged in classroom and distance learning teaching. In order to inform this effort a focused literature review on training materials development was initiated with the goal of optimizing training materials development for the intended audience. One result of this effort, which is now an ongoing involvement with research in the area of adult learning, was the development of a format and a method for software training materials that has proven especially suitable, effective, and flexible, which is rapid to implement and has been well received. This brief paper describes some of the results of our literature search, the training materials format we developed based on it, the method we evolved to develop these materials, and suggestions for possible further research.

Characteristics of Effective Learning Materials for Adults

According to Williamson,

> Adult learning and development researchers tell us that adults prefer instruction that is self-directed, reflexive, experiential, relevant, solution-oriented, and transformative

> (learner's biases and assumptions are challenged). Training must also activate, affirm and build upon prior knowledge and real-world experience and have immediate and practical application. (Merriam, 2001, as cited by Williamson, 2008).

This sums up perhaps better than any other single statement the essence of effective professional development training.

Our review of the relevant literature, however, identified the work of several others that also has a direct bearing on the way in which software training materials can be developed for maximum learner benefit. Bannert explored the utility of minimizing the software feature set to which learners were initially exposed and also compared the effectiveness of instructor-led materials with self-instruction materials, and determined that in his experiments user satisfaction and acceptance of the various training approaches was identical, yet learners experiencing self-learning materials "achieved significantly better learning outcomes than students in the 'human tutor' group." (Bannert, 2000). Bannert also found that while learners exposed to a subset of system functionality learned significantly faster, they did not—in contrast to the assumptions of Carroll, upon whose "training wheels" approach his work rested (Carroll, 1990)—experience better learning outcomes. Leutner identified that focusing on a subset of software functionality first, and gradually expanding the focus, while at the same time beginning with heavy guidance and gradually relaxing it, were more effective as a strategy than any other combination and manipulation of these factors, and confirmed that ignoring these factors in the design of a training approach for software almost invariably was less effective (Leutner, 2000). Venkatesh and David determined that prior to hands-on experience with a new software system, a user's perception of the ease of use of the system is based primarily on the individual's own self-conception of their computer skills in general, but that an objective sense of system usability is gained after direct experience. Further, the nature of that sense of usability is tied intimately to the nature of the direct experience and the satisfaction, or lack of satisfaction, experienced by the person in that contact. (Venkatesh and Davis, 1996). Yi and Davis accomplished an in-depth validation of and evolution of an observational learning model confirming that training in which a learner observes how a task is accomplished and then models the same behavior produces superior training outcomes to those of approaches relying more heavily on the theory behind an operation or recitation of the results of an action (Yi and Davis, 2003). Ricci et al. studied whether an approach to training in which new skills are taught as part of a game were as or more effective than traditional step-by-step ("test and text") explanation and drill and determined that the game approach was superior in specific instances (Ricci, Salas, and Cannon-Bowers, 1996). Especially insightful is very explicit human-computer interface analysis of training materials provided by Carroll, Smith-Kerker, Ford, and Mazur-Rimetz in describing the design and formation of a "minimal manual" guide for the development of self-instruction materials, which combines the development of very specific notions of instructional material content and expression with focused experiments to evaluate the outcome of their use (Carroll, et. al, 1987). With the exception of the work of Ricci et. al. the approach we settled on for the development of training materials for the university environment relied on and benefited from all of the findings of this prior research. Rather than trying to invent a new wheel from scratch, we very much felt that our efforts benefited from the knowledge already gained by others in this area.

Defining Requirements

The primary intent of the training materials development process undertaken was the provision of materials that could serve the purpose of instructor-led training to be conducted in one to three hour sessions. However it was also necessary to envision that the same materials should be useful to learners for self-instruction and reference purposes. It was anticipated that training sessions would be conducted in a lab setting accommodating as many as 16 personnel at a session with each participant seated at a live computer capable of accessing the software which was the object of the training. It was projected that the incoming skill level of participants would vary considerably even for training which was segregated by content as to a new user or existing user audience. Further, a time constraint existed at the outset to provide initial learning materials for the most critical training needs within a relatively short timeframe, with additional materials to follow within a period of weeks thereafter. The specific content of training materials on the immediate agenda included Blackboard for faculty (both new users and users familiar with simple processes), Endnote, a locally-developed survey tool named QuickData, audio presentation preparation, editing and podcast provision, video presentation preparation, editing and presentation, and the impending university-wide upgrade of the Microsoft Office Suite from 2003 to 2007. All of this was to be accomplished with a staff of two

training materials developers and three trainers, with considerable overlap between these two sets of personnel, housed organizationally in an area also populated with technical support personnel, audio/visual technicians and the team of Blackboard administrators.

Implementation of the Training Materials Design

The principles and beneficial practices derived from our literature search led directly to the design goals to be met by an optimal (or, at the least, a superior) type of learning materials. The materials had to:

- be concise—contain the minimum necessary verbiage to accomplish the purpose
- provide focused coverage of specific topics with work-related outcomes relevant to the audience
- provide coverage in context to incur the minimum necessary learner orientation to applicability
- be intuitive in nature and require no, or an absolute minimum, of additional explanation
- lend themselves to accurate, consistent, and rapid learner interpretation.

By fortuitous circumstance it became evident that it is possible to satisfy many of these requirements with an implementation method that not only provides the desired product but also is substantially faster to implement than the traditional "user manual" approach stemming from the legacy of early technical writing. The user manual approach begins with the assumption that written materials are primarily that: words supported by focused illustrations. The approach we developed to meet the design goals reverses this and recognizes that when software training is the goal the object of focus is the entire screen viewed by the user. Words are secondary and their placement must reflect the primacy of this fact and the overwhelming importance of the context provided by the entire screens viewed by the user, which literally is the software system to the user.

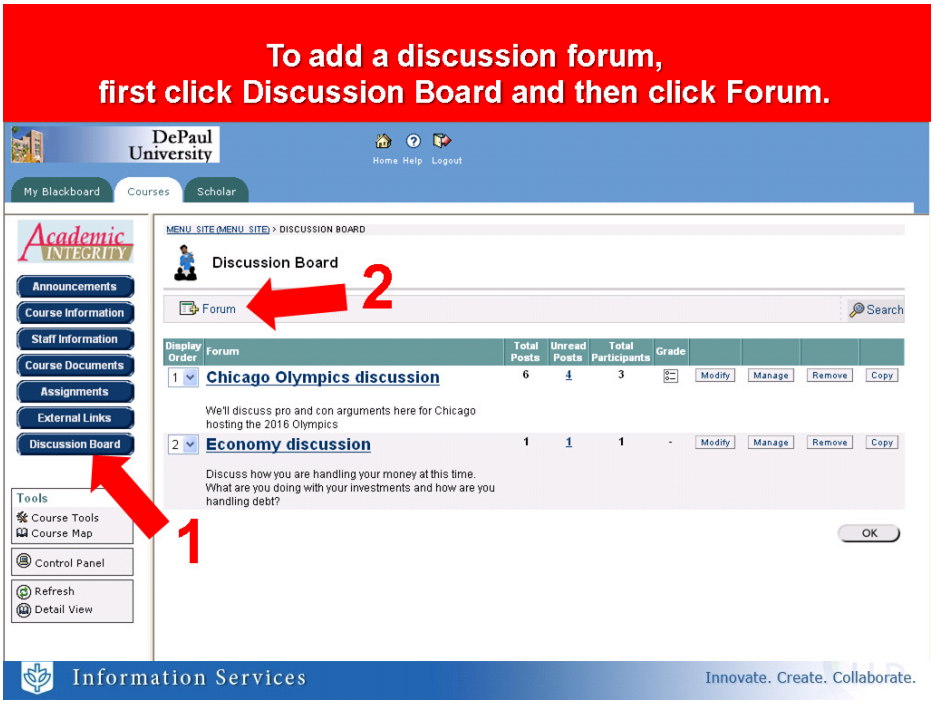

Figure 1 – Example in a series of training slides developed using the developed method

The method developed to satisfy our requirements relies on the ready ability to capture an entire screen as a graphic image, as illustrated in Figure 1. A simple keystroke carries this into the "memory clipboard" from which it can be inserted directly into a Powerpoint slide. On a personal computer under Windows this function is accessed by

holding down the Shift key and pressing the Print Scrn key. The image thus copied to the clipboard can be inserted into a slide by going into Powerpoint, creating a blank slide, and pressing Ctrl/v to insert the image from memory. The image can be resized to fit the slide by grabbing a corner and moving it diagonally toward the center, then aligning a corner of the image to the corner of the slide and sizing it to completely fill the slide. In the case of web-based software accessed via a browser, the "crop" function of Powerpoint 2007 can be used to trim out the top part of the screen and the status line at the bottom to reduce visual clutter and provide room for a concise instructional message area at the top of the slide. (Alternatively, the screen image can be pasted into a photo editor and the cropping action done with the editor, and the image output as a .jpg file to be inserted into a slide. This method has the advantage of actually reducing the size of the graphic image, while the internal Powerpoint 2007 crop function leaves the image at its original storage space requirement.) In addition to the top of screen instructional verbiage, stand-out block arrows, heavy circle borders, or inset text boxes in a distinctive color can be used on the screen image itself to call attention to items. The intention with these is to provide the kind of attention-drawing visualization analogous to that which would occur if an instructor were standing next to the learner, looking over his or her shoulder, and physically pointing out the item and identifying and explaining important points about it. The intention of using full-screen images in all cases is to avoid the kind of "out of context" learner confusion that often ensues when only a fragment of a screen is illustrated, which is almost always the case if training materials are viewed as traditional "user manuals" or ordinary technical writing.

Figure 1 illustrates one of a series of instructional slides developed using this procedure. This particular slide set consists of about 50 images that quickly convey in a two-hour, three-exercise hands-on session what has changed from earlier versions of the Blackboard C/LMS between those versions and the current version 8. In this example the learner is directed to take two actions, the first of which leads to the ability to accomplish the second. In this slide series the slide after this one illustrates the result of the second action and contains additional brief instructions about how to continue with the series of actions required. (This entire set of training slides and exercises is available at the web link indicated at "Materials for Download" at the end of this paper.)

Results and Outcome

Implementation of the chosen design has proceeded smoothly and we have found that the following method for development of a new set of training materials has provided consistently superior results:

1. Inventory the basic functions of interest to learners at a given pre-training course level. This is done by interviewing a key set of end users prior to training materials development, examining the functionality of the software being replaced or upgraded, and by relying on the experience of faculty members who serve on the Instructional Technology Development staff.
2. Identify the end products or things learners will know how to produce or accomplish by taking the training—the specific work products they will be enabled to create, not the steps or software functions to which they will be exposed; see Carroll's "Minimal Manual" admonition on page 129 (Carroll, 1987).
3. Sequence the topics to be covered within a training course and develop a hands-on exercise for each. Break a complete exercise into steps that can be expressed in a few lines.
4. Perform the step-by-step sequence of operations needed to accomplish each exercise and capture each screen, creating a slide in the pattern illustrated in Figure 1. Explanatory words (if needed) are carefully chosen and edited so that they are concise and not verbose, so that they always fit within the top border area and within a supplementary annotation box with 24 point type.
5. Sequence the slides and perform a copy edit on the entire set, adjusting wording to insure consistency between slides and exercises sheets.
6. Pilot test the training with a small initial group and publish the slides at the group's web site for optional download by learners. Refine the slides and exercises as dictated by this experience before releasing them for widespread use.

Conclusions

It has been our experience that the product and method for its development which grew out of our research effort has enabled our relatively small group of trainer/materials developers to create our needed materials with appropriate content in minimal timeframes. After assuming responsibilities for this training with the 2007 calendar year we have successfully conducted an average of three weekly sessions throughout the academic year covering an expanding set of software. The clear emphasis on learner work-product outcomes and the front-end design incorporated into this process has made it possible to parcel out development work on the same course between multiple trainer/developers yet still achieve a consistent product when the parts are joined together. A given three-hour training course with five to ten short exercises may require as little as two weeks to develop through the pilot test stage, which has proven to be a boon to the rapidly-evolving software and training needs of the university as peaks arise during the academic year.

Future Improvements and Research

Several additional developments in this area suggest themselves. One which is nearing the point of implementation is the use of the "Notes" feature of Powerpoint to add a small amount of explanatory verbiage to slide sets themselves, which would be ignored during the use of the slides and exercises for instructor-led training but could useful to self-guided learners. This would in effect completely reverse the traditional "manual based" training materials paradigm because the "manual" would be the last product developed rather than the first. The lack of traditional training manual materials has not handicapped our efforts in the two years since we assumed responsibility for this area but manuals may yet be of assistance to self-paced learners and to our own staff as turnover occurs. Formal research to assess the utility of our existing efforts and gauge the outcomes of this additional documentation effort are in the planning stages.

An additional area of extension lies in the provision of audio annotation for the slide sets, to (perhaps) further improve their utility and usability. Methods to accomplish this are under evaluation including the overarching question of whether the audio need be tied to the slide presentation or completely separate and free-standing, given the software tradeoffs and flexibility, or lack of flexibility, of each approach.

Development of a method to organize short segments of learning in a web-based "how to" reference is also on the agenda, to serve both our user community and the university help desk. Pilot testing of a simple method to produce the HTML necessary for such a site is underway.

Research is underway to identify an optimal method for the provision of slide sets to learners via the web, with the goal of minimizing or completely eliminating software dependencies and any specific equipment type requirement. Since our faculty use a mixture of Windows/PC and Apple machinery our distinct preference is for presentation methods that are not limited to one specific type of computer and which impose no presentation requirement other than a browser. These efforts are projected to result in additional research publications during the next several months.

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Materials for Download

This paper in .pdf form, and a matching slides set, are accessible for free download at the "Conference Materials" button at the DePaul University Instructional Technology Development web site at www.itd.depaul.edu.