LESSONS LEARNED WHILE MOVING BETWEEN DIFFERENT TRAINING DELIVERY SYSTEMS

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ABSTRACT

As new delivery systems are being made available and affordable, there is a rush to import old data and training into new formats required for the new delivery system. Stand-up courses are being loaded onto web pages and computer-based instruction is being incorporated with electronic performance support. Change is occurring at a very fast pace. Organizations seeking to expand and update existing training materials into the newer delivery systems are presented with unexpected challenges.

Different training delivery systems have their own characteristics that prevent the materials from being easily converted from one format to another. This paper will describe the policies applied and lessons learned in converting traditional instructor-led materials to computer-based instruction. The paper will discuss issues addressed at each phase of the instructional systems design process and strategies for successful conversion. The following areas will be discussed:

- Misconceptions of conversion projects.
- Resolving issues that arise when moving from traditional training to technology-based delivery systems.
- Streamlining the design and development of converted instructional materials.

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EVOLUTION OF TRAINING DELIVERY SYSTEMS

Training systems are evolving. As new systems become available and affordable, older systems such as stand-up and paper-and-pencil programs are being re-purposed into the newer formats. Instructor-led courses are being replaced by self-paced computer-based modules and web-based lessons. Electronic performance support systems are being developed to incorporate training requirements. Change is occurring at a very fast pace, challenging organizations seeking to expand and update their existing training materials.

This paper presents a case study in which stand-up (instructor-led) courses were converted to computer-based instruction (CBI) courseware. The paper further describes the policies followed and lessons learned by the conversion team at each stage of the instructional systems process. These policies and lessons learned are not restricted to a stand-up/CBI conversion and updating project; they are readily applicable to other conversion projects in which an existing training system is modified to fit a different delivery system.

Common Conversion Misconceptions

The word "conversion", practically defined, involves the repurposing of existing materials into another instructional format. Because different delivery systems have different characteristics, materials conversion projects are often not as simple as they might first appear. The conversion misconception often fails to take into consideration the overall complexity that the creation of a digital delivery medium requires when compared to stand-up instruction. As with any program, underestimating the scope of work required when repurposing materials is dangerous because it puts the three critical areas of a program; technical, cost, and schedule at risk.

The popular assumption that repurposing or converting materials provides for accelerated development and lower costs by providing the means to skip entire phases of the Instructional Systems Design (ISD) process is a common misconception among many buyers and sellers of CBI. While repurposing materials can lower development costs, there are still many variables that must be addressed during each phase of the ISD process.

Because the ISD process is iterative, revisiting each step of the process insures a successful conversion in all critical areas of a program. If the scope of work is significantly more than what was projected, the results may be the development and delivery of instructional materials that are ineffective. At best, an incorrectly estimated conversion effort will wreak havoc on a project's cost and schedule in order to deliver instructionally sound CBI materials.

Revisit All Stages of Instructional Systems Process. A successful conversion project must revisit all stages of the instructional systems process. Although they had not planned on doing so, the program team had to continually go back and forth through the ISD phases in order to ensure closure of all potential gaps in audience, content, media, and instructional methods to guarantee the delivery of a quality product.

Do Not Underestimate the Full Complexity Impact of Multimedia. This issue is often discovered too late into the CBI effort and can result in cost overruns or schedule slips. Despite initially making this error, the program team was able to successfully meet cost and schedule by continually readjusting design and development efforts as guided by frequent strategic calibrations made throughout the effort by the lead Subject Matter Expert (SME) and instructional designer. Examples of strategies employed by the program team include utilizing the electronic work environment, leveraging and scaffolding content, multimedia elements, and code as well as optimizing reviews utilizing SME, instructional designer, and management inputs.

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OVERVIEW OF THE SETTING

In this case, Harris Corporation contracted to convert two traditional stand-up technical training courses into CBI for a government agency. The two courses, one containing 12 lessons and the other containing 17 lessons instructed learners on the capabilities and operation of their communication system, which was designed and engineered by Harris.

The Harris program team, comprised of managers, programmers, instructional designers, and SMEs, used Macromedia's Authorware 4.0 to program the CBI lessons over the period of approximately twenty months.

Implement Best Commercial Practice Guidelines. The guiding policy of the program team was to follow Best Commercial Practice (BCP) guidelines and process flows for CBI development during the conversion effort. These BCP guidelines are based on the ADDIE instructional systems design (ISD) model. ADDIE represents five basic stages of the ISD process, including Analysis, Design, Development, Implementation, and Evaluation.

The program team adapted a flexible multi-layered approach to the ADDIE model with concurrent effort occurring simultaneously throughout the ISD phases. This flexible adaptation of the ADDIE model improved efficiency by enabling the small Harris team to multiplex across the courseware development in a non-linear manner. When team members had ideas for improvement or conversion issues that were out of sync with the best practice guidelines, the program team collaborated and determined the best method.

ADDIE CONVERSION PROCESS

Analysis and Project Definition

During the instructional systems analysis phase, the customer and CBI program teams collectively identify the need for instruction and define what is to be learned by the students. At this time, analyses are completed which profile the program needs, operator tasks, and target audience. As a result, the program team defines the instructional goals and objectives, and the media presentation level. The program team developed a level II CBI product (medium simulation) in which students have moderate control over lesson presentation with a moderate level of interactions. The outputs of the analyses included a Training Plan and a Course Design Guide, creating a traceable plan for the training program.

The analysis phase is frequently overlooked or significantly cropped during conversion projects. This often occurs because analyses previously conducted for the original instructional materials are assumed acceptable in order to keep costs down. However, as the program team learned, there are many factors to consider before deciding to re-use old analysis data. Time and evolution are the primary factors to consider, as minor or major changes may have occurred since the original training development in these and other areas. (Updates would not be done in a pure conversion contracted effort):

- System data and construction
- System operational requirements
- Operational tasks
- Target audience
- Job descriptions
- Performance standards

In this case, many of these factors impacted the CBI development. Since the initial stand-up training analysis, the hardware and software for the system evolved; operating tasks and job requirements changed to match the newer system baselines; and, the target audience evolved from one of experienced system operators to developmental operators. These changes significantly affected the CBI effort, requiring additional analyses to be performed to supplement or replace the historical data.

Verify Validity of Materials to be Repurposed and Accuracy of Analysis Phase Outputs if Updating is Required. Investing time and effort into an ISD analysis, performed by the CBI instructional designers and SMEs, would have prevented the Harris project team from continually halting, reversing, and revising their efforts. Because the analysis phase sets the pace for the design and development for the entire project, an up-front investment in ensuring data accuracy for the conversion and updating project is worthwhile.

Without accurate, up-to-date analytical data, the conversion project suffered from inconsistencies and constant changes throughout the effort, as the new data and requirements increasingly became apparent. Ultimately during the development phase, the program

team performed a moderate level of analysis work in order to deliver technically accurate and instructionally sound lessons. However, because analysis was not bid into the CBI proposal, performing the analysis effort put the project schedule and budget at risk.

Mitigate Multimedia Requirements Risk. Very early in the effort, while reviewing the stand-up instructional materials for technical updates, our SMEs also identified possible graphics, multimedia and other technical references that would later become invaluable data sources for filling in every screen on the visually demanding media. This data enabled the team to more efficiently identify and successfully develop all the visual and multimedia instructional elements.

Utilize a Project Schedule. The program team was often at a disadvantage because the schedule did not match their BCP guidelines or terminology. In executing the conversion project, the program team would have benefited from a project schedule that appropriated more time for reviews and reserved time for anomaly resolution. The program team strongly recommends that the project schedule's terminology and milestones reflect the team's development processes and guidelines, or unfavorable disconnects will occur.

Implications for Design

The design phase of an ISD project specifies how the learning will occur. During this phase the instructional strategies, methods and media most appropriate for the program and learning requirements are identified and agreed to with the customer. Outputs from the CBI design phase included an Instructional Media Design Report, Lesson Design Strategies, Style Guide, and Conventions List.

In a conversion project, the team uses the design phase to optimize and develop the instructional design and media opportunities afforded by the new delivery system. During stand-up instruction, most of the instructional design practiced by stand-up trainers is performed as the instruction is actually delivered; many instructors attend to the students' practice and feedback needs, pace of instruction, learning styles and motivation in real time, as required. CBI design and media must attend to these same requirements.

Account for Providing Fully Supportive Informational Units. While stand-up courses permit the instructor to respond to students in an improvisational fashion, CBI is restricted to providing the information contained within the course content. Therefore, the CBI team must identify thorough informational requirements for the target audience, anticipating the questions and gaps in knowledge likely to be experienced by the learners. The SMEs were very successful at achieving the right balance of technical information for the customer's training modules and it proved critical to the instructional success of the two courses.

Account for Differences in Student Interaction Capabilities. Because the media used by delivery systems can be so different and stand-up interactions are frequently undocumented, a conversion project team cannot rely on the existing stand-up materials to provide designs for student interactions. Stand-up interactions are very open with few limitations on student opportunities to interact with the instructor. Conversely, CBI, as a contained unit of instruction, must incorporate the most effective points of student interaction with the system. CBI interactions serve as a guide, in which the instructional system determines the most appropriate time and content to emphasize to the students. The program team learned that designing technically meaningful interactions can become quite time consuming when full multimedia and system emulation requirements are factored in.

Use Electronic Storyboards. After the design planning for the new courseware is documented, design storyboards are the next chief product of the design phase. A key strategy used by the program team was to storyboard lessons using the authoring software within which the end courseware product would actually be programmed and delivered.

The storyboarding process contained several steps. First, the SMEs and instructional designers worked on their lessons by adding content, rearranging items and changing the document's formatting elements to match the conventions and styles used in the CBI courseware. The lesson plans were saved as RTF files and imported into Authorware where the imported files created corresponding lesson flows and icons. Then, the SMEs and instructional designers developed their lessons using designated areas of the screen to describe in detail the lesson content, including text, graphics, audio scripts, animations, simulations, student interactions, and video. The lessons were fully designed, reviewed by SMEs and an instructional designer, and updated in Authorware before continuing on to the development

phase during which the electronic storyboards were fully programmed.

Following this approach significantly streamlined the storyboarding process by eliminating the often inefficient storyboard-to-authoring software conversion, enabling edits to be quickly implemented and reducing the dead end storyboard paper trail.

The main drawback to electronic storyboards that the program team discovered was that the digital format permitted the often pressed-for-time content designers to provide minimal directions to programmers and artists. Sometimes this resulted in confusion and rework, but in other instances, this shortcut often saved time with no issues. Overall, if properly applied, electronic storyboards can significantly expedite design and development processes.

Courseware Development

Design materials are produced in the development phase. At this time, programmers and graphic artists incorporate the storyboard specifications into electronic courseware complete with audio recordings, student interactions and graphic and video implementation. Regarding a conversion project, the development phase is the least likely to be replicable from the initial effort. Clearly, stand-up development and CBI development are not fully comparable due to the CBI's capabilities as a multimedia and visually rich medium. The conversion team should be prepared to manage the development phase with sound policies and processes specifically geared for creating materials for the new delivery system.

The development phase in a CBI project requires extensive reviews unlike those performed for a stand-up course. CBI development reviews not only determine the accuracy of presentation content, but must also identify accuracy of the multimedia elements including audio, video, graphical and timing elements.

Maintain Detailed Status Checklists. The program team found that maintaining detailed status checklists for each lesson was extremely helpful in maintaining procedures and preventing revisions from getting lost in a pile of paperwork. The status checklists were extremely successful because they mapped to the team's CBI development processes, and at any time in the development phase, all members of the team were able to access the precise status of each lesson. The checklists also simplified status and milestones measurement and fostered team communication. The checklists provided additional motivation because as team members completed a task, they initialed and dated its completion. The program team strongly recommends implementing these tracking sheets.

Implementation and Delivery

Implementation is the application of the instructional product under operational conditions. The implementation of CBI involves coordinated computer setup and software installation, vendor maintenance support, and courseware management. Stand-up implementation typically involves verification of written materials content, instructor preparation, and checking out the delivery media, such as overhead projectors. Because the implementation of stand-up varies a great deal from the implementation of CBI, the CBI conversion team cannot base implementation planning and execution according to the previously implemented stand-up product. Often, customer requirements determine the aspects of this phase.

Uphold Design Treatment Integrity. During customer reviews and student walk through evaluations, the recommended instructional sequence of the materials was not followed. Subsequently, the team received many review comments that were invalid when the courseware was taken in the prescribed sequence. The course map and lesson sequencing specified in the design phase must be maintained during customer reviews and field use of the courseware. Because each lesson is instructionally designed to satisfy prerequisites and informational flow, changing the sequence when the courseware is implemented will likely result in student confusion and ineffectiveness of the CBI. The program team recommends implementing a policy or contract requirement that requires the adherence to previously agreed upon design documentation.

Evaluation Phase

Evaluation in any ISD project is on going, and applies to all other phases: analysis, design, development, and implementation. Evaluation determines the adequacy of the product, instructionally and operationally, generating feedback to the project team and enabling total quality management. The customer, students, and team members provide evaluation throughout the life of the system.

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Evaluation of a project generally occurs in two forms: formative and summative. Formative evaluations, such as individual and small group try-outs, are performed before product implementation. The frequency and format of these interim evaluations depends upon the relationship between the customer and the conversion team. Progressive formative evaluations, using customer and student feedback, are recommended to ensure that the team is indeed producing the product expected by the customer, and to verify that the instruction is sound and effective in meeting its stated objectives.

Exercise Flexibility during Product Reviews. For this CBI effort, the program team and the customer mutually agreed to have three iterative Internal Review Meetings (IRMs) along with 100% complete review and student evaluation trials. The reviews were often held at Harris, but several reviews were successfully conducted long distance via CD-ROM to accommodate the customer review team's schedule. The typical format of the IRMs was fairly informal and collaborative due to the two team's successful work history. The structure and tone of the IRMs significantly reduced unnecessary paper work and time delays when transmitting and resolving review comments; many review comments were discussed and resolved in real time.

Allow Media To Improve Your Process. During IRMs, the customer team reviewed the electronically coded storyboards and final lesson screens, only printing out screen captures of courseware frames requiring their comments. There was plenty of space at the bottom half of the screen captures for the reviewers to draw or make notes. This proved to be a very efficient means of reviewing the courseware and consolidating comments. Both the customer and the contractor have been very pleased with the time and materials this process has saved.

Summative evaluations assess the impact of the instructional system on job performance. Summative evaluation activities and results are coordinated with the customer, and may be performed by the CBI team or by the customer. In this case, the customer conducts the summative evaluations.

Just as analysis is frequently abbreviated in a conversion project, so is evaluation. Conversion projects, often performed in an effort to rapidly replace or update existing materials, frequently assume that the product will operate satisfactorily based on the previous performance of the original instruction. However, because the delivery systems differ tremendously as cited throughout the ISD phases, regular evaluation activities are critical to the new system's success.

SUMMARY OF LESSONS LEARNED

- Revisit all stages of instructional systems process.
- Do not underestimate the full complexity impact of multimedia.
- Implement Best Commercial Practice guidelines.
- Verify validity of materials to be repurposed and the accuracy of analysis phase outputs if updating is required.
- Mitigate multimedia requirements risk.
- Utilize a project schedule.
- Account for providing fully supportive informational units.
- Account for the differences in student interaction capabilities
- Use electronic storyboards.
- Maintain detailed status checklists.
- Uphold design treatment integrity.
- Exercise flexibility during product reviews.
- Allow media to improve your processes.

Conclusion

Whether a stand-up to CBI conversion, or another category of conversion, the benefits of reapplying all phases of an instructional system far outweigh the apparent advantages to rapidly piecing together re-purposed content in a new delivery system. Although the promised immediate time and cost savings of a strict conversion strategy seem effective, repairs may be required to the new system, as shortcomings in instructional effectiveness and system functionality may continually emerge during the development effort. These unexpected but necessary repairs can put a project's technical, cost, and schedule at risk.

The strategies and policies employed by the program team were key to the success of the CBI conversion effort. The program team's flexibility, adaptability, and excellent working relationship with the customer, resulted in the project being completed on time and within budget. Leveraging content, multimedia elements and code enabled the courseware designers

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and developers to increase their efficiency and streamline product development.

A significant lesson learned was the criticality of re-evaluating how the courseware conversion activities will be accomplished in order to fully exploit the nature (and benefits) of the digital medium. The program team successfully exploited the characteristics of the electronic medium to communicate with team members, share information, utilize electronic storyboards, and improve courseware design and consistency. As the program team members look to the future, they are currently evaluating other ways to further exploit the digital delivery mediums to improve efficiency and effectiveness when converting or creating courseware.

When moving between different training delivery systems, project policies and management should be carefully planned and put into effect using an instructional systems approach, including activity in each phase. In this era of multimedia and conversion projects where making the most of existing resources is the premise for low effort with a high return, the program team also recommends utilizing proven program management policies, including frequent risk mitigation and strategic planning. The results of these policies and strategies is a satisfied customer using an instructional system that meets each objective in the instruction while delivering the desired learner performance on the job, and the successful execution of a CBI program that maintained the correct balance between technical aspects, cost, and schedule.