Using the Layers of Necessity Model to Implement Large Instructional Design Projects[1]

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Introduction

In 1995, The Gas Company and its parent, Pacific Enterprises, were in the midst of what was probably the largest restructuring and downsizing the companies had ever known. Bill Wood, the chairman of the corporation, said it was like taking apart and reassembling a jet liner while in flight. For many of us, the effort continues and is a long way from being over. The impact on training at The Gas Company has been huge and will continue to grow for the next couple of years. The fallout from the "reassembled jet liner" has been a major challenge for Instructional Design, both as a threat and as an opportunity. We have had to manage a major project involving cross-functional teams, tearing apart and reassembling courses taught by over thirty instructors, and meeting ever-changing deadlines in an ever changing environment. In seeking ways to conceptualize the project, which we call the Training Redesign Project, so its goals could stand out as a beacon in all the confusion, we found the Layers of Necessity Model first described by Tessmer and Wedman (1990) to fit our circumstances very accurately. The purpose of this paper is to describe how their model has helped us keep our project goals in perspective, providing us so far an excellent business solution, and to identify criteria from our experience indicating when the model could be a valuable tool in meeting other instructional design challenges.

Background

When this all began — about three years ago — the training department at The Gas Company was on course for developing a kind of "corporate university." Unbeknown to the key players in the department, the Company itself was moving in another direction, not necessarily coherently, toward decentralization as new strategies became attractive to our senior executives. The ones with immediate impact on the Instructional Design group were, first, restructuring of the entire company into business units and, second, the complete redesign of field jobs. Both of these were attempts to sharpen the focus of company operations on customer values. By redesigning field jobs, the company planned to reduce 47 job descriptions to 28, while expanding each individual employee's duties to handle a substantially greater range of customer requests more quickly. This plan was developed confidentially to avoid a premature confrontation with the union. The realignment of the company into business units, on the other hand, meant for us backing away from the corporate university concept. Instead, Office and Field Training were parceled out to

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different departments in the business units, while Business and Leadership Training and Instructional Design were placed in a central Personnel department under General Support Services.

Redesigning the field jobs to cover more tasks in fewer job classifications meant all the existing training also had to be redesigned, first, to cross-train incumbent employees, qualifying them for their expanded responsibilities and, second, to create new courses by combining elements from old courses. In anticipation of the considerable amount of work this implied, the Instructional Design staff was not downsized during the company's restructuring.

The second major change, separating Instructional Design from the groups responsible for training delivery, placed us in a newly formed section of Personnel called Employee Development so that we would be "centrally located" to serve all the business units. Our new managers had expertise in areas other than training and limited exposure to instructional design.

We had had the opportunity a year earlier of converting one twenty-day course from a traditional topic-focused course to a modularized, performance-based course following the conventional ADDIE instructional design model (Stormes, 1996). The main impression that exercise left on management was how quickly we were able to assemble special purpose training courses for employees who had to learn only portions of the primary job.

Issues

The issues facing us when we began planning the Training Redesign Project in October 1995 were somewhat daunting. The job was huge; we estimated that approximately 1000 modules would evolve from the existing course content, which totaled 1034 days. The average module length was estimated at five hours after time for practice was eliminated. They could take seven years to develop (based on our previous experience and that of others outside our organization) if our entire staff of eight designers devoted full time to the project, which they could not. That immediately raised another issue. Our new managers expressed the opinion: " Instructional design takes too long and costs too much." A third issue was how to overcome the hurdles facing us and the training groups in dealing with the new corporate structure, reporting to different business units, and all trying to find their way within the new organization, each with a different agenda.

To add further complexity, our senior management had agreed that validated testing should be included; that is, incumbents learning new skills for their new jobs had to demonstrate entry-level competence as a result of the training or be assigned to a lower level job. While testing is a part of most current field training, it has not been a critical determinant for getting a new position, so this was a new challenge for the traditional field employee. It also brought another player into the course development picture, the personnel assessment analyst, who was responsible for editing and revising all knowledge test items, running test validation sessions, and working with the instructors in creating performance tests as well as knowledge tests.

Assessment of Resources

One of the first things we did in organizing the project was to assess the instructional design and course development resources and tools we had available.

Project Staffing

Besides the Instructional Design staff which had survived corporate downsizing almost intact, many of the instructors whom we had worked with over the previous two years had also remained. They had considerable experience teaching as well as extensive content expertise. They were familiar with instructional design concepts and some had actually had the opportunity to apply what they had learned in workshops to their own courses. The opportunity they offered was to leverage somehow their experience and content knowledge to make the course redesign project move forward more efficiently.

The personnel assessment analysts brought testing expertise to the project but the primary focus of their experience was selection testing . They had no experience with criterion-referenced testing, which is a critical piece of pass/fail testing for performance-based instruction.

Instructional Design Standards and Procedures

We had recently published instructional design standards and had offered a workshop on instructional design standards and procedures for people who were likely members of the teams.

The instructional design standards include guidelines for planning a project followed by detailed recommendations for conducting an instructional design project. The target audience for the handbook was instructional designers with some experience in the discipline. The original idea was to help establish uniformity on a team project like this, but not to educate. For that reason, we tried to have all team members receive training in instructional design and course development through outside workshops (e.g., Sink). We provided the workshop to review basic instructional design principles and to demonstrate how to use the book as a reference.

Another feature of the handbook is that it includes a set of formatting templates to adapt to the requirements of a particular design project. Electronic versions of the printed templates are available on our file server and on disk.

Software

We were fortunate that our prior management had kept us equipped with up-to-date software and computers. Besides the familiar Microsoft Office for Windows, we had available Microsoft Project for project planning and Visio to support project management.

Some other software we worked with during the year or so prior to this project were Mystro and Survey Pro. Mystro is a hierarchical database system. It allows us to build a job analysis showing a breakdown of all tasks and link those to the major components of the courses in which these

tasks are taught. Survey Pro has evolved into an efficient tool for collecting opinion and factual data and reporting it succinctly for evaluation and tryout purposes.

Obstacles to the use of resources

As already indicated, the newly decentralized organization of training functions did not bode well for the success of the Training Redesign Project. Officially, Instructional Design's authority was limited to advice and support but it was the only organization with experience in leading a course development project of this size.

Management committees making decisions about the design of the new jobs had to conduct their business in private. They kept us informed but the information came slowly and was subject to frequent change.

A new job analysis was needed for the new jobs. Although the components of the jobs had not changed very much, they had just been regrouped, our previous job analysis had not covered the knowledge component of tasks in detail; so another job analysis was conducted by the personnel assessment analysts. The analysts, however, could not speak directly to performers because of the need to keep the company plans confidential prior to new union contract negotiations.

At the time the project was being planned, we expected that training incumbents in their new jobs would begin no later than the beginning of 1997. We had only a year to perform a project of such a size and scope that estimates based on traditional guidelines indicated we could barely get started in such a short period.

The Layers-of-Necessity Model as Organizing Principle

All of these barriers were reduced significantly by adopting the Layers-of-Necessity Model as an organizing principle for the redesign project. It gave us a way to look at the project from a long term perspective while investing only as little as necessary to accomplish specific objectives along the way. It provided a way to communicate with all stakeholders, both those assigned to the team and those who were funding it or responsible for the outcomes of the job reclassification efforts. The Layers of Necessity Model provided a readily grasped vision of the project that promoted consensus by aiding our communications about both immediate and long-term benefits.

Definition

The Layers of Necessity Model includes all of the traditional tasks of instructional design, but it differs from the conventional model in the way the work is performed over time. Conventional design assumes the course or training materials have to reach final form before being used. The Layers Model says to go through the tasks focusing your effort only on what must be done to reach some usable, intermediate goal. When that has been completed, you go around again, only this time focusing on a longer term goal, and so forth. As Tessmer and Wedman (1990) say, "Based on the time and resources available to the developer, the developer chooses a *layer* of design and development activities to incorporate into an instructional product or project. *The*

layer is matched to the necessities of the project." The model differs from the conventional design model by being more flexible in adjusting to the practical limits of time and resources. Instead of reaching for a target quality level in one pass through the process, quality is developed over time as a project moves forward through successive layers.

Distinctions Between the Layers of Necessity Model and Traditional Approaches

Tessmer and Wedman point out five critical distinctions in the approaches, each of which we were able to apply almost intuitively to our situation. In the following summary, the first phrase of each distinction represents the traditional view and the second, italicized, represents the Layers of Necessity view:

Distinction	Perspective	Example in the Training Redesign Project
Task closure vs. *task enhancement*	Instead of each task being completed before going on, each task is completed just enough to get the immediate job done.	We divided the whole project into 3 layers based on what was needed at different times over the life of the project.
Procedure-based vs. *principle-based*	Principles not procedures need to govern what must be done at each layer.	"Don't reinvent the wheel": use existing training materials to the greatest extent possible; don't conduct analyses (e.g., audience) where you already have data.
Discrete stages vs. *merged stages*	Reduce analysis to the minimum and merge with development tasks.	Merge objectives, course, and test item writing in one development stage.
Comprehensive vs. *opportunistic* perspective	Adjust project scope to what is immediately available and at hand.	We leveraged the expertise of instructors by working with them on objectives, having them write drafts of lesson plans and test items.

Effectiveness-based vs. *efficiency based*	Accept that the effectiveness of training may be suboptimal in favor of getting the training available within the time and resource constraints.	We used standardized templates; e.g., a lesson plan template with a standard introduction presentation, and practice format. (Adopted from Clark & Sugrue, 1990)

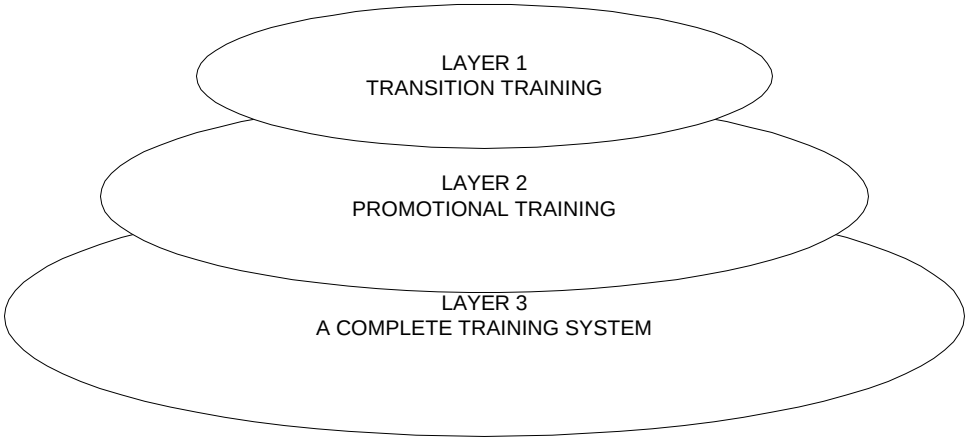
The result of this analysis was we were able to set three distinct goals for three layers of development that corresponded with our best estimate of present and future needs for training. The immediate need was to have training delivered early enough to qualify most incumbents by the end of 1997. The annual budget for design was increased but not enough to cover the extensive redesign we had to do. (For a useful article on decision making factors and principles with this model, see Tessmer & Wedman, 1992.)

The first layer was defined as dividing current training content into modules based on performance requirements and preparing performance objectives, instructor outlines, and test items for each module. By having instructors write their own material, we eliminated a lot of time normally taken by instructional designers to become familiar with the content, attend existing classes, and otherwise learn what the instructor already knows instinctively. This was the primary factor in reducing the cost of first layer development to about one-sixth what we previously experienced. That left plenty of room for funding the next two layers.

The second layer, which begins in early 1997, focuses on creating complete courses for employees who have been promoted and for new hires. The modular approach we used to develop the first layer courses pays off here. The modules will be reassembled as full courses. Appropriate transitions will be included. Test construction will match the new organization of the modules, since they are linked to the modules and the performance objectives cited there. Since this version of the curriculum will be permanent, it will be worthwhile to devote additional resources to the development of student workbooks and handbooks, including job aids.

The third layer will begin late in 1998. Its focus will be the lesson plans. The current Layer-1 plans are designed to be used by instructors already experienced in teaching. We believe they will be too brief for new instructors who may come in to replace promoted or retired instructors. Also, we expect by that time to have gained perspectives through the entire project that will open up prospects for alternative delivery modes, for example, CBT and structured OJT. At that time we should be in a position to realize our ultimate goal, a complete system for field training. The following illustration depicts this progression.[2]

[2]See attached "Application of Layers of Necessity Model" for initial analysis applied to this project.



The Layers of Necessity Model as Applied to the Training Redesign Project

The Current Situation

At the present time we are nearing completion of Layer 1. We are waiting for final approval of recommendations from review teams (composed of management and union members) to begin implementing the transition courses. In keeping with the merged-step principle of the Layers of Necessity model, we are using the first presentation of each transition class as a tryout. Revisions will be incorporated as soon as possible without holding up the training schedule.

Summary of Lessons Learned

Instructional design principles have developed from a tradition of determinism and analysis based on practices in systems engineering, psychology, and communication theory. The practice has been shaped on one hand by the need to do the very thorough content analysis required for self-instruction. Developers were naturally concerned that they had included sufficient content so students could learn on there own, without an instructor. Yet, on the other hand, developers have used cost-benefit analysis to justify long lead times without considering the opportunity cost of not having the promised training available at the time it is needed. The Layers of Necessity Model seems to be an easily understood way to structure the systematic design process required and, at the same time, reveal ways to tap returns from the investment long before the entire project has been completed, thus meeting the business need more quickly and more effectively.

Laying out the entire project in terms of the Model has helped team members and sponsors keep in mind both short and long term goals. It has helped manage expectations better so we can deliver on time and within budget more reliably. Since the Model helps make the relationship between cost and value clearer, it has essentially eliminated the old criticism that we cost too much and take too long.

If we had a full staff of highly trained instructional designers technically competent in gas distribution and customer service who could have authored all of the training, we may have taken a different approach. The Model has, however, helped us match the demands of the job to the capabilities at hand, marrying the expertise of the instructors with a standard course design template. Instructional designers were able to assist in interpretation and in guiding the instructors. The results, if short of ideal, will, we are confident, produce the required student learning while providing a highly effective learning experience for the instructors and the instructional designers as well. There is no way of predicting what the long term impact of their involvement in course development following the performance-based approach will be, but the instructors have had an excellent opportunity to broaden their capabilities as instructors and course developers.

A concern that might be raised is the increased redundancy as the design process is to some degree revisited at each layer. We believe that this can be managed by clearly defined tasks as we begin the new layer in conference with the client organizations. Also, there is an advantage to this redundancy, in that technical advances and competitive issues are going on at an accelerated pace. The planned cycles of design and development offer an opportunity to integrate these changes and keep the training up-to-date.

There are two things we have learned about large organizations like The Gas Company over the years. One is that there is a continual struggle between progress and the status quo. The other is that management fads sweep through a company, produce a great deal of activity, and often disappear. The Layers Model has for over a year now given us a structure that has so far survived initial skepticism, acrimonious labor negotiations, and the distraction of a proposed merger with San Diego Gas & Electric. At this point, the question is not whether or not our performance has met the Company's immediate needs, but whether we can remain viable and visible among all these other issues and get the go-ahead to proceed with the next layer and on toward our ultimate goal of transforming training at The Gas Company, or will senior management lose interest before the three layers are completed.

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Biographical Information

John M. Stormes

John Stormes was introduced to instructional design in the mid-1960s, in the heyday of programmed instruction and wild prophecies about the power of multimedia. He wrote training materials and managed a variety of training development and behavioral science projects over the next 20 years, settling down finally in the training department of The Gas Company about 11 years ago. Here he has supervised the development of training video scripts and collateral material and has managed a number of sizable instructional design projects. He is currently project manager of four instructional design teams redesigning all of the Company's field training courses. He is a Past President of the Los Angeles Chapter of ISPI. John holds a Bachelor of Science degree in physics from San Diego State University and a Bachelor of Arts degree (English) and a Master of Arts degree (cinema) from the University of Southern California.

Carolyn Johnson

Carolyn Johnson's corporate experience includes 17 years with Southern California Gas Company, with the last six years in training delivery and design. As a Training and Development Facilitator, Carolyn has been highly regarded for her presentation and group facilitation skills. She is currently working as a lead instructional designer on a major training redesign project. Carolyn holds a Bachelor of Arts degree (music) from California State University, Northridge, and a Master of Arts degree in Management from the University of Redlands.

Application of Layers of Necessity Model to Plans for Field Training Redesign for Reclassification Project

Task enhancement

1996 Module development for training incumbents

Design Step	Scope of Activity
Situational assessment	Keep development and delivery as simple as possible
Goal analysis	Limit to job analysis, setting priorities, validating priority decisions with field management
Instructional strategy development	Follow generic 3-section module design based on 15 steps, including testing. Leave simulations, self-instruction, and field exercises as is, incorporating them into appropriate modules
Material development	Develop new materials only if none exist. Rescope, clean up, and reformat existing materials -- do not rewrite
Evaluation and revision	Tryouts to be conducted with real class and then revised. No special tryouts other than possible one-subject tryout if absolutely necessary.

1997 Integration of modules into courses for new hires, transfers, and promoted employees

Design Step	Scope of Activity
Situational assessment	Movement within the company will require courses for untrained employees.
Goal analysis	Organize modules into coherent courses separated into steps for in-grade advancement, reducing cost and increasing effectiveness of training

Instructional strategy development	Sequence training according to DIF principles and add appropriate introductory and transitional material. Identify selection testing and qualification testing requirements
Material development	Package modules into courses. Refine student materials. Put testing system into place
Evaluation and revision	Continue in situ process

1998 Enhancement of courses for incorporating new delivery modes and for use by new instructors

Design Step	**Scope of Activity**
Situational assessment	Experienced instructors will rotate out. New technology and new management culture will make new modes of training delivery feasible.
Goal analysis	Help new instructors become effective instructors quickly. Reduce training costs by having more of it conducted in the field or through self-study.
Instructional strategy development	Enhance lesson plans (based on priorities) to include more detail for new instructors. Identify high-leverage opportunities for development of self-instruction and structured OJT
Material development	Publish new lesson plans. Create multimedia, self-study workbooks, or structured OJT modules according to strategic goals.
Evaluation and revision	Use more formal methods of evaluation for self-instructional materials. In situ evaluation for enhanced lesson plans.

Principle-based decisions

Principles of:	**Principle statement**
Selection	To the greatest extent possible, limit to available materials: job analysis being done for testing, available course outlines, available student materials. Add only high priority materials that are not currently available.
Implementation	Use simple formats consistently. Implement only to the degree relevant to the immediate goals, e.g., training incumbents in 1996-1997.

Merged stages

Conventional analysis, design, development, implementation stages will be merged and extensive analysis and design tasks eliminated or reduced to bare necessities.

Performers	**Task description**
Instructional designer (ID), personnel analyst (PA)	Develop TPO specifications and test content specifications from Job Analysis database.
ID, PA, and subject matter expert (SME)	Collect existing information in response to 3 questions: What student does to demonstrate accomplishment of TPO, what he/she must know, and what is the reason for the task(s) supported by the TPO.
ID, PA, reviewed by SME	Prepare level-1 lesson plan, exercises and tests, and student materials when necessary.
ID, PA, instructor	Conduct tryout with first enrolled class. Determine changes needed, revise accordingly.

Opportunistic perspective	• Use existing materials as much as possible. • Control to meet time, cost by selecting high benefit, low-cost activities. • Apply priorities to determine what will be done, what may be done, and what can be eliminated or postponed.
Efficiency-based design/ development approach	• Use existing templates, practices, and simple review and tryout systems. • Trim delivery time by standardizing and consistent adherence to simple guidelines. • Do not look for better practices unless they fall out opportunistically.