

Meta Patterns for Developing a Minimalist Training Manual

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1. Introduction

These Patterns are a guide to the creation of a minimalist training manual and are extracted from existing knowledge in The Nurnberg Funnel by John Carroll. The target audiences of these patterns are any company's organizational units, having a need to train new hires or cross train existing staff on the unit's particular work functions. In some cases new knowledge will be captured and crafted into training materials with this process. Using the eight "principles" of minimalism captured in these Patterns, one can "define" minimalist instruction. There is no deductive theory of minimalist principles; we cannot just crank out a training manual. Design never works this way (1). It would be appropriate to use an Agile process for creating the manual, guided by the eight principles embodied by this collection of Patterns. These Patterns will serve as guides to a process that will create the minimalist training objects; an Agile process is recommended. The company's organizational unit will form a team that will create minimalist Training Objects using this process guided by these Patterns. These Patterns formulate the basic tenants of Minimalism in the form of a pattern collection to guide the creation of Guided Exploration Training Objects taking the form of p-forms. The end result is a pedagogical method called "Guided Exploration." These Patterns differ from the established Pedagogical Patterns in that their target audience is groups of people at work in a typical office environment, performing on-the-job training. This training will be performed by the person doing the work, not a trained educator, for other employees, and not classes of students. The training materials produced by these Patterns are to support this purpose, one for which massive amounts of material are typically needed and very little of good quality actually exists.

1.1. Definitions

Minimalism is a style of writing training materials that allow trainees to start immediately on meaningfully realistic tasks, reduce the amount of reading and other passive activity in training, and help make errors and error recovery less traumatic and more pedagogically productive (1). Minimalism emerged in the early 1990s, around the same time as Patterns and Pattern Languages, and research supports its effectiveness (1). Minimalism asserts three core guidelines: More to Do, Less to Read, and Help with Errors. These three basic guidelines are broken down into eight principles: Training on Real Tasks, Getting Started Fast, Reasoning and Improving, Reading in Any Order, Coordinating System and Training, Supporting Error Recognition and Recovery, Exploiting Prior Knowledge, and Using the Situation. According to Carroll, "when one is designing instructional materials what is important is the key idea of minimizing the extent to which instructional materials obstruct training. The starting point for such design is an eclectic synthesis of available design elements marshaled to address instructional objectives and usability objectives (1). Such material "requires a high degree of modularity, a structure of small, self-contained units" (1). P-Forms are such an "eclectic design element" (1) addressing the principles of "Less to Read," and "More to Do." The traditional "Minimalist Manual" consists of sets of Guided Exploration Cards, which are these modular, self-contained units. This set of Patterns mines

Carroll's work in Minimalism, establishes a pattern for each of the eight principles, and will create a different kind of Minimal Manual, one consisting of P-Forms and not the traditional Guided Exploration Cards. While Carroll's research was very strong, the bibliography of this paper lists published academic research that independently supports Carroll's research and the project of Minimalism in general (3,4,5,6,7).

A P-Form is a piece of documentation structured like a Pattern but containing new or emerging knowledge, not existing established knowledge, and has not gone through the PLOP conference process. Instead the P-Form is shepherded and work shopped internally, by the community that will use it, and may never appear in a Plop publication. The knowledge and process contained within P-Forms may also be much more volatile than in a Plop approved Pattern. Like Patterns, P-Forms follow Minimalism and are a form of Minimalist documentation. P-Forms are a proposed format drawn from this author's doctoral research and are not applied widely at present.

A "Training Object" is a small, self-contained, and self-describing digital resource used for training that has a specific purpose (2). In Minimalism, the "Guided Exploration Card" is the Training Object. The results of this Pattern set will be P-Forms, which will be the Training Object and will support Guided Exploration, but will be different from traditional Guided Exploration Cards. The suggested benefits of using P-Forms over Guided Exploration Cards are based on the theory that P-Forms can harness the power of Patterns and Pattern Languages to convey rich information, and thus represent an improved mode of knowledge sharing and management. As Alexander says in his Timeless Way of Building, the patterns are there whether we verbalize them or not. Software designers have known for a long time that by using Patterns we can come to a more conscious realization of what it is we are doing, helping us to communicate better--more precisely--and ultimately contributing to a greater implicit understanding of good design. Therefore the finished form of the Minimal Manual is preferred to be a set of P-Forms instead of Guided Exploration cards.

The Pedagogical Patterns Project will be referred to in this paper as the "PPP." Many of the patterns in this paper share the same fundamental principles developed in the PPP patterns for academic education, and PPP Patterns will be cross referenced where relevant.

1.2. Motivation

The Systems Approach to instruction addresses itself to the logical and hierarchical decomposition of overall instructional objectives and the decomposition of these into enabling objectives. Each objective is incorporated into a systemic lesson structure incorporating specific "events" of instruction, such as gaining the trainee's attention, informing the trainee of the objective, eliciting performance, enhancing retention, training transfer, etc. The factors that would motivate a trainee to work through such well-sequenced but pragmatically fragmented lessons are never discussed and are simply assumed to be present. Adult trainees are directed to practice and perform under the assumption that they will be happy to demonstrate their ability. Human problem solving is neither confined to nor always well served by typical manuals organized around a hierarchical system designed to control the direction of the training. Going from high-level objectives down to specific exercises leads to fragmented sessions.

Training activities in such manuals are often carefully chosen, but not meaningful to the users. People tend to lose their motivation to work through such material and taking this orientation seriously raises deep questions about the adequacy of the Systems Approach (1).

The work of John Carroll (1) includes research giving strong support to the idea that people do not read big training manuals, and the more comprehensive such manuals are the less useful they become. This applies even to people who express a sincere commitment to reading the manual before they start. The research demonstrates that even such people do not read the manuals. Therefore it is not a good idea to give someone a task and say you must read the entire manual before starting. Carroll's work and research published in other academic papers (3,4,5,6,7), demonstrates that it is better to create the smallest possible instructional guide that enables self-directed training taking advantage of what people already know, letting them get started quickly (without having to read a lot first), and letting their mistakes be teaching opportunities. A set of patterns can achieve the development of such training guides, using certain methods and concepts established in the PPP (9) but in a context different enough to warrant a set of patterns that articulate guidance specific to workplace training. This pattern collection mines the principles behind Carroll's approach to minimalism so that these principles can be used for developing minimalist training materials for the workplace.

The Seminars Pattern Language (10) also contains a set of pedagogical patterns for the purpose of developing and running professional seminars. The context of Seminars is a little closer to this set of patterns and a few of the same basic concepts apply, however Seminars does not address self-guided on the job training.

2. The Pattern Collection

This paper contains the following patterns:

GUIDED EXPLORATION (starting pattern)
TRAINING ON REAL TASKS
GETTING STARTED FAST
REASONING AND IMPROVING
READING IN ANY ORDER
COORDINATING SYSTEM AND TRAINING
SUPPORTING ERROR RECOGNITION AND RECOVERY
EXPLOITING PRIOR KNOWLEDGE
USING THE SITUATION

PPP patterns THREE BREARS, MULTI-PRONGED ATTACK, EXPOSE THE PROCESS, and CHALLENGE UNDERSTANDING (9) can also help guide this overall effort, adjusting the context to relate to the on-the-job training for which the present patterns are written. Avoid WIDER PERSEPECTIVE; while important for higher education you will find that individuals undergoing workplace training do not want this and will not respond to it. Seminars patterns INVISIBLE TEACHER, DIFFERENT EXERCISE LEVELS, and LET THE PLAN GO (10) capture core concepts for self-directed learning. DIGESTIBLE PACKETS (10) would also be a helpful guide, not really addressed by this set of patterns.

3. The Patterns

3.1 GUIDED EXPLORATION

Context: One has been asked to design a training manual to enable rapid on-the-job training. The instructional materials must enable trainee-directed activity and accomplishment. The manual itself must be written quickly as well.

Problem: Designing a comprehensive training manual based on the 'systems approach' costs much time, and the results of these on-the-job trainings are often insufficient.

Forces:

- For a training manual to be useable it must be short, but completely fulfill all the training goals
- One cannot design a training manual that is both useable and comprehensive.
- Research supports that manuals containing too much detail distract the user away from the training or are simply not read by the user (1, 3).
- Instructional models do not generate deductive theories and tend not to be reducible.
- We cannot mechanically generate effective training.
- While potentially productive, individual differences between trainees tend not to be useful in guiding effective instructional strategies under the systems approach.
- The development of instructional materials remains a matter of direct empirical analysis and iterative adjustment of particular tradeoffs.

Solution: *Give trainees materials that encourage and guide active training. Follow the principles of minimalism: TRAINING ON REAL TASKS, GETTING STARTED FAST, REASONING AND IMPROVING, READING IN ANY ORDER, COORDINATING SYSTEM AND TRAINING, SUPPORTING ERROR RECOGNITION AND RECOVERY, EXPLOITING PRIOR KNOWLEDGE, and USING THE SITUATION.* The team that is tasked with creating the manual should apply this pattern as their starting point, and then follow through to the rest of the collection. The design methodology can be an iterative Agile process guided by this set of Patterns capturing the principles of minimalism. Agile processes have been used successfully to create high quality documentation rapidly (8), and thus would be a good fit help pull together diverse sets of information and individual expertise to develop a manual quickly. A more traditional approach may be successful too, though over a longer timeframe. The goal of this process is to create a set of P-Forms that suggest goals and activities, and to serve as reference material for use during self-initiated trainee activities. This set of P-Forms will be the "manual" that supports the user's "guided exploration," or self-initiated and self-directed training activities. Such will be a set of Materials radically different from standard systems manuals will be produced, instantiating the minimalist instructional model. These materials will support people treating training as purposeful exploration.

For example, you are tasked with writing training materials about how to produce your departmental risk reporting. This is a complex data collection and display task, one that is highly customized around your specific organization's activities and risk profile. P-Forms such as GET THE DATA and UPDATE

GRAPHIC, among many others, will need to be developed to guide your colleagues on how to produce these risk reports accurately and timely.

Resulting Context: What will occur is a trade-off of promoting personally meaningful activities while sacrificing some of the comprehensiveness of systems-style curricula. The result will be training and achievement that is faster and more efficient than with standard Systems Manuals (1).

Rationale: Human training is paradoxical. The tension between personally meaningful interaction and guidance by a structured curriculum entails a priori limitations on how much we can ever accelerate training. There is no instantaneous step across this paradox. The project of minimalist instruction is to make an attempt to narrow this step, to try to exploit the sense-making capabilities and propensities people bring to a training situation in order to produce more efficient training (1). Research by Lazonder et al, Rosson et al, Van Nimwegen et al, Choi et al, and Seals (3,4,5,6,7) supports the basic principles of minimalist instruction. This pattern resembles the PPP Patlet EXPLORE FOR YOURSELF (9), developed to support learning in an academic setting. Seminars patterns DIGESTIBLE PACKETS, LET THE PLAN GO, DIFFERENT APPROACHES, and WORK FORMS (10) may help guide and enhance this overall effort, as they speaks to dimensions of training session scope in a way that this present set does not.

3.2 TRAINING ON REAL TASKS

Context: The key contrast between minimalist instruction and the systems approach to instruction is that the latter addresses itself to the logical and hierarchical decomposition of overall instructional objectives and the decomposition of these into enabling objectives. Each objective is incorporated into a systemic lesson structure incorporating specific “events” of instruction, such as gaining the trainee’s attention, informing the trainee of the objective, eliciting performance, enhancing retention, training transfer, etc. The factors that would motivate a trainee to work through such well-sequenced but pragmatically fragmented lessons are never discussed and are simply assumed to be present. Adult trainees are directed to practice and perform under the assumption that they will be happy to demonstrate their ability (1).

Adults training on computing tasks in the context of the workplace already have goals. They do not come to computer applications to be drilled, led step by step through prerequisites, or tested for mastery of trivial skills.

Problem: Human problem solving is neither confined to nor always well served by typical manuals organized around a hierarchical system designed to control the direction of the training. Training activities in such manuals are often carefully chosen, but not meaningful to the users. They want to get something done, and instruction that fails to support this motivational orientation fails as instruction. People personalize their own knowledge and skill through their activities. Taking this orientation seriously raises deep questions about the adequacy of the systems approach (1).

Forces:

- Going from high-level objectives down to specific exercises leads to fragmented sessions (1).

- One makes the familiar an instance of a more general case and produces awareness of it.
- The fundamental objective of education is intellectual and moral “autonomy,” not superficially normative performance.
- Identifying with an activity is a powerful source of motivation that can enhance training.
- System-style lesson structures threaten to occlude the forest from the trees.
- The structuring discipline of systems approaches specifically counter-influences the human trainee’s organizational propensities and is an overall limiting model (1).
- People tend to lose their motivation to work through such material (1).

Solution: Find out, from the user’s domain, what goals and meaningful activities would productively facilitate training and performance. Allow the trainee to select meaningful tasks to work on, to personalize instructional projects, to pursue a sequence of goals each a meaningful end in itself, not a mere step meaningful only as part of something else (1). For example, after applying this pattern one should have created a set of P-Forms addressing specific functional goals. An example P-Form called “GET THE DATA” might be produced to guide trainees in how and where to obtain data for departmental risk reporting; the task they are being trained to perform. The task would be the real one, not an abstract training case.

Resulting Context: This will engender identification with the activities, which is a powerful source of motivation that can enhance the training. Such training is achieved when the training task is the trainee’s task, when the training situation is under the trainee’s control, when the training activities are personalized by the trainee. In this situation each goal and each new episode of interaction come from and belong to the trainee and to that extent are already meaningful even if in detail they are unfamiliar. This will yield a richer training experience, as research has shown that the moment to moment goals and interactions are more important to maintain trainee motivation than the overall, long term goals (1). A possible liability with this pattern is that much of the material relates to original problems and specific training goals, and as such the material cannot be standard, and cannot be completely developed in advance. This will cost the instructor and trainee more time; however it can be accomplished in a small number of iterations.

Rationale: Research has shown that activities undertaken directly in the service of a meaningful goal were remembered concretely, accurately, more effectively, and more durably when contrasted to those undertaken merely as a means to other ends (3,4,5,6,7). This pattern resembles PPP pattern REAL WORLD EXPERIENCE (9) and shares a similar concept, however the context of on-the-job training materials makes it different enough to warrant its own pattern. There is significantly less abstraction required for training on work tasks. Also the resulting training materials will usually be for individual use, and less often for work teams. Concepts in the Seminars patter RELEVANT EXAMPLES (10) are relevant to this one.

3.3 GETTING STARTED FAST

Context: When the structure of the curricula obstructs meaningful activity, it can undermine the basic human drive for achievement and competence, ironically transforming the desire to learn into a training

problem. The systems approach of presenting orientation material up front makes it very easy to slather on many layers of introduction, orientation, preview, and review. Next the systems approach presents a prescribed sequence of basic concepts and techniques. None of this facilitates the user's desire to get started on meaningful activity (1).

Problem: The systems approach to training places obstacles in the way of getting started by failing to enlist the natural energies that sustain training.

Forces:

- Natural energies towards spontaneous training fail to be enlisted.
- The systems approach relies on training prerequisite skills in a prescribed sequence by reading and drill, on being told the basic concepts and then practicing for mastery.
- Plodding through a systems framework may not be useful to trainees.
- Training by reading often conflicts with the more basic need for getting something done.
- People learn by induction from concrete examples, not from being told how to do things.
- Extrinsic guidance of conceptual elaboration and practice with numbered steps are techniques that often become obstacles to training (1).

Solution: Have trainees start fast on projects that they recognize as realistic. Use TRAINING ON REAL TASKS to identify such activities, and this pattern to get them going right away. Utilize READING IN ANY ORDER too, as this will help the users get started quickly. The minimalist approach urges getting trainees started doing projects as quickly as possible, allowing meaningful and concrete activity to provide intrinsic training guidance. This is an appropriate way to view skill development – as iterative “getting started.” Your instructional design should permit trainees to engage only in personally meaningful activity. An example of this pattern's use would be the creation of a set of P-Forms titled “TWO MOST IMPORTANT THINGS,” to identify the two most important things one must know before starting, and “WHAT IF I GET STUCK,” which would be another P-Form to guide one if they encounter an obstacle, which would occur quickly if they start fast (1). Such P-Forms need to help facilitate nearly immediate hands-on learning.

Resulting Context: Natural energies such as curiosity, a desire for competence, aspiration to emulate a model, and a deep-sensed commitment to the web of social reciprocity will be enlisted and will sustain rich experiences of spontaneous training (1). A liability is that the trainee might feel lost for a while, and may feel like they are wasting time.

Rationale: There often seem to be good reasons for giving trainees a thorough orientation before allowing them to interact with a system. Unfortunately these reasons are beyond the grasp of the trainees themselves or merely irrelevant to their more immediate concerns. Accordingly, the good reasons do nothing to ameliorate the frustration trainees can experience. The goal of real training is obstructed (1). This pattern resembles PPP pattern TRY IT YOURSELF (9), but the purpose and context is different. The purpose of GETTING STARTED FAST is to accelerate the work training activity, not to guarantee that students understand a concept through the use of assigned exercises before moving on

to a more advanced concept. Both do involve forms of self-directed learning, but the context is quite different.

3.4 REASONING AND IMPROVING

Context: Standard instructional designs follow the axiom that the user will follow training exercises correctly and completely. However, this requirement is tantamount to the assumption that there is one best way to learn, one optimal sequence of activities – namely the sequence codified in the curriculum. Research has shown, though, that trainees rarely conform to this one best way. It is not enough to merely acknowledge the abstract desideratum that trainees need to reason and improvise on their own, while providing them with one-best-way training curricula in which there is no place for these activities. Thinking creatively about the training task is usually a departure from the prescribed curriculum and is technically an error, according to the system’s approach (1).

Problem: Conveying to the user that there is one single success path will inhibit training by a kind of bureaucratic fiat; at worst it will precipitate frustration, confusion, and error (1).

Forces:

- Instructional materials can pose questions themselves.
- Instructional materials could explicitly encourage trainees to pose and then investigate questions that interest them.
- Instruction can guide the trainee to pose productive questions and to adopt appropriate methods to investigate them (1).
- Trainees exercise initiative and make choices, even if they are not given the prerogative to do so.
- The standard design approach tells one what to do, it does not want the trainee to make choices or exercise too much initiative.

Solution: Allow people to reason about what they are doing, and allow your trainees to partially create, and not merely consume, instructional material. Present people with incomplete materials for training. Cut and condense text and other passive components with a goal towards enriching the training experience. The trainee needs more to think about but less to overcome (1). For example, when writing P-Forms for whatever goal is being attempted, deliberately leave them incomplete. This will force the trainee to think, reason about what they are doing, and make their own improvements. For instance a “GET THE DATA” P-Form might leave out details related to the sources of the data, its organization, its schema, or how one might optimally filter it so that the trainee is forced to think for themselves a little, and thus learn more. The trainee will make errors from time to time so be sure to incorporate the SUPPORTING ERROR RECOGNITION AND RECOVERY pattern.

Resulting Context: Cognitive processes will be enhanced in a variety of ways. Research has shown that actively generating elaborations for material being learned can make it more robust in memory (1,2,3,4,5,6,7). Having incomplete training materials will encourage users to engage in active self-elaboration. Incompletely specified, open-ended training tasks are often more motivating. Tasks are

better remembered and more likely to be returned to if they are incomplete on first encounter. This will also result in a substantial reduction in the volume and verbiage of training materials (1). People will not have to read as much about what they are doing. A possible liability is that the trainee might never understand the training goal and will need help. This will ultimately improve the training materials and the trainee's knowledge, however extra time will be consumed.

Rationale: The assumption that there is one best way to design human activities may be a fundamental fallacy of applied psychology, including instructional design. It is more helpful pedagogically to permit self-directed reasoning and improvising. People who are doing self directed improvisation do not need to read as much about what they are doing. Clarity comes from understanding the material to be conveyed and the people to whom it will be conveyed, not from tacking on grids and extra labels (1). There are several relationships between this pattern and PPP patterns. STUDENTS DECIDE (9) contains similar ideas, however one is likely to get too much variety and more material than can be used if this PPP pattern were used without restraint. The context is different in that this pattern maintains that a focus on one single, established success path inhibits training, while STUDENTS DECIDE maintains that students need to be engaged in the course planning process because their exact skills or interests cannot be known in advance. These are really different problems. This pattern relates to ONE CONCEPT SEVERAL IMPLEMENTATIONS (9), and while the rationale is similar the PPP pattern leaves less up to the student than the present one. Most of the rationale behind EXPOSE THE PROCESS (9) and NOBODY IS PERFECT (9) relate to the present pattern, though in a significantly different context warranting a pattern addressing problems and solutions specific to workplace training. Seminars pattern LET THEM DECIDE (10) contains concepts related to involving audience collaboration that may guide one in creation of minimalist manuals.

3.5 READING IN ANY ORDER

Context: Many reading problems that occur in the use of training materials seem at first to be design errors: material out of order or steps that leave out important details or include unimportant directions. However when one considers redesigning materials to remedy such problems, many times one encounters design trade-offs, that is, issues that if resolved one way will cause one problem, but if resolved another way will cause another problem. Standard training materials are necessarily linear but dependencies among various topics within them tend to be non-linear. When people refer to instruction opportunistically in support of their own goal-directed activities, it becomes difficult or impossible to predict what sequencing will be appropriate even when the logical dependencies are merely linear (1).

Problem: When people try to learn by reading through sequential sets of steps they are frequently unsuccessful. Likewise any training activity that does not have interactive, hands-on components will have limited results.

Forces:

- Sequencing problems reside in the material and in the trainee's use of it.

- It becomes difficult or impossible to predict what sequencing will be appropriate even when the logical dependencies are merely linear.
- Common techniques for easing such interdependencies are themselves problematic, such as in the case of Indexes.
- Indexes often fail from a lack of consensus about what terms should be indexed.
- Readers often prefer browsing to a structured searching (1).

Solution: Try to eliminate sequence, materials that can be read in any order cannot be read in the wrong order. This requires a high degree of modularity, a structure of small, self-contained units. The internal structure of the units must be simple so that trainees can successfully skip over or skip units (1). For example, in using this pattern, develop P-Forms that address their own procedural problem without reference to material dealt with by other P-Forms. Each P-Form should be able to be used independently. Make sure to use TRAINING ON REAL TASKS. Try to lead trainees to other tasks if necessary to acquire the skills that are needed, and let them discover the dependencies within the materials themselves.

Resulting Context: Trainees will usually use material in any order they wish, regardless of its format. Following a minimalist design, attempting an advanced task “out of order” should motivate and help guide the acquisition of prerequisite skills that may have previously seemed irrelevant. Minimalist materials therefore support and productively use this tendency to read in any order (1). A liability is that this is not always easy to do and may occasionally be compromised. If the material can lead the trainee to other tasks that will help them acquire more skills and discover dependencies with aspects of the materials themselves then this liability may be minimized.

Rationale: One cannot eliminate the need for prerequisite knowledge in training, but one can minimize the tangles and side effects that occur when prerequisite relationships are disregarded (1). This pattern has no relevant PPP pattern, PPP patterns present very linear pedagogy. Seminars pattern SEPARATE SIMILAR CONCEPTS (10) is relevant and adds guidance to this pattern.

3.6 COORDINATING SYSTEM AND TRAINING

Context: Systems that do not already have a high degree of tutorial software integration try to guarantee coordination of the system and training merely through the hope that trainees will read with unceasing discipline and earnestly comply in order to maintain adequate coordination. Yet research has shown that such faith in reading as pedagogically adequate guidance is not warranted by the facts of training. The assumption that “people are very obedient if you tell them in advance” is false. If such an assumption is necessary for system-style materials, those materials cannot be appropriate for real trainees (1).

Problem: Trainees who become too absorbed in some aspect of the system or the training risk breaking the tenuous link between the two. This tends to penalize people for trying to learn, for being interested enough to pay attention (1).

Forces:

- Faith in reading as adequate guidance has been demonstrated to be unwarranted.
- Any training that assumes one will read everything in advance and then follow it obediently and precisely will likely fail.
- People are good at seeing temporally and spatially proximal, singular causes for observed effects.
- People are not good at recognizing disconfirming evidence for hypothesized causes (1).

Solution: Don't expect trainees to read with unceasing discipline and earnestly comply in order to maintain adequate coordination, but incorporate richer implicit and explicit linkages into the training materials. The linkage between the system and the training needs to be flexible and robust (1). For example, when creating P-Forms periodically display a figure demonstrating what the display should show if all is well. A valid sequence of causal inferences in a real task that is constrained and prototypical can be used to guide trainee attention to relevant disconfirming evidence. Write each P-Form to include a goal statement, hints, check points, and remedies (1). Leave hints incomplete and not in ordered steps. A GET THE DATA P-Form might have a "try and see" hint around the filtering of data, a checkpoint that indicates successful retrieval of data, an incomplete remedy that might lead to P-Forms supporting error and recovery, and other checkpoints to keep track of progress. READING IN ANY ORDER comes into play here, as well as GETTING STARTED FAST, and TRAINING ON REAL TASKS.

Resulting Context: Once rich and explicit linkages have been incorporated into the training materials, if trainees only make use of these explicit links to verify that a miscoordination occurred they will still be ahead. The trainee's task goals and task-oriented reasoning strategies will provide an implicit structure for coordinating attention to the system training (1). A liability is the lack of a comprehensive guide that could be used as a reference. Such a guide is occasionally helpful to refresh or enrich one's memory.

Rationale: It is easier to distract attention than to disrupt reading sequence, and systems style manuals frequently do exactly this because of problematic integration between system and training (1). This pattern is similar to the PPP pattern ACTIVE STUDENT, which suggests that reading alone is often insufficiently active and that short readings should be followed by activities (9). ACTIVE STUDENT (9) is a good conceptual guide, however its context refers to activities in an academic class, not self-guided training. One is less likely to miss disconfirming evidence during self-guided training, and this serves an important pedagogical role. WAR GAME (9) contains similar concepts of learning by doing, however it is more coordinated with reading and in this pattern there is no game involved and no group. "TINY, SMALL, AND LARGE, (9)" and SOLUTION BEFORE ABSTRACTIONS (9) also give good guidance towards experiential learning but can-not be substituted for this one in creating job training material. Seminars pattern EXERCISES EMPHASIZE PROCESS (10) has some relevant concepts.

3.7 SUPPORTING ERROR RECOGNITION AND RECOVERY

Context: Much of what trainees do is "error," but error is a diverse category. Sometimes the trainee has an appropriate goal but takes an inappropriate action. Sometimes the goal and the action are appropriate, but a pre existing condition precludes the usual, and intended, effect. The trainee might have an appropriate goal and take appropriate action but still be "wrong" because the tutorial steps

currently in effect specified other activities. There are straightforward cases in which the trainee has some misconception and accordingly takes incorrect action and difficult cases where the trainee has the wrong idea but somehow gets a reasonable result (1).

Problem: If errors are never made or if they are made but not clearly analyzed, the trainee will lack the raw material to construct an understanding that discriminates between errors and nonerrors (1).

Forces:

- Current training manuals often have no error recognition and recovery support.
- The assumption is false that if trainees proceed with step-by-step care they will have no trouble.
- Requiring that the trainee have no trouble is too little to ask for.

Solution: Design training that supports the recognition of and recovery from errors in order to help ensure that when errors are committed they are productive for the trainee. Build a compelling inventory of user errors, particularly those that are typical or have serious consequences. Ask trainees to make as many errors as possible, or have one trainee recover from errors committed by a partner. For example, each P-Form should have a remedy section, though it is also helpful to create general recovery support P-Forms like “WHAT IF I GET STUCK.” Trainees need to know that they can get out of any situation they get stuck in, but the P-Forms you are creating need to show the trainee how to unravel an error situation with awareness of how it had occurred (1). In each P-Form the remedies section should be incomplete, to force the user to reason and improve, and thus learn from their errors.

Resulting Context: Trainees will have an improved ability to recover from errors and in self initiated forays of exploration errors may play a unique constructive role in facilitating the discovery of new knowledge (1). A liability is that a trainee could end up spending inordinate amounts of time on simple errors that could be easily resolved with the help of a systems manual.

Rationale: The pervasiveness of error in training makes it unrealistic to imagine that trainee error can be eliminated. Moreover, many cognitive theorists and educational psychologists have concluded that error can play an important and productive role in training and intellectual development. Some experience with error may be essential to the training process (1). Here the PPP has recognized the value of errors and error recovery in pedagogy and covers this subject much more comprehensively. BUILT IN FAILURE and MISSION IMPOSSIBLE (9) have a very similar context and may be even more relevant to the on-the-job training context than their academic context. FIXER UPPER and EMBRACE CORRECTION (9) also have a similar context and spirit.

3.8 EXPLOITING PRIOR KNOWLEDGE

Context: One of the most important aspects of training design is the understanding of users’ prior knowledge and motivation and then finding ways to exploit it. Were it really the case that trainees came to their tasks as blank slates, systematic instruction might work. Not having specific goals and expectations might make trainees more amenable to drill and practice techniques, more willing to read, less likely to reason and practice on their own. However, this is not the case (1).

Problem: Training designers don't know everything. Adult trainees bring abundant prior knowledge to every new situation, and such knowledge will often suggest goals and interpretations to the training that even the training's designers did not know (1). The designer may create training tasks that do not match the expectations of the trainees, the tasks may be too high or too low-level, and in such cases will tend to be de-motivating. It is also easier to remember things that are presented in an already known context.

Forces:

- Adult trainees are not novices; they are experts in domains other than what they are training in.
- Training materials are weakened when they fail to incorporate prior knowledge.
- Humans are more successful solving problems that can be related to prior understandings.
- Adult trainees have an abundance of potentially relevant knowledge that can be used to help solve existing problems, motivate the acquisition of new knowledge, contribute to, and enhance the training materials overall (1).

Solution: Understand the trainee's prior knowledge and motivation, and then find ways to exploit it. There are a variety of techniques for capturing and representing knowledge, however to a great extent purely empirical, commonsense approaches can suffice (1). For example, when writing P-Forms make sure they conform to what you expect the learners already know. For example, the GET THE DATA P-Form should exploit the trainee's existing knowledge of databases. This will place the training goal in the larger and more familiar context of office work (9). It is also important to avoid confusions stemming from knowledge the trainee already has. Lastly try to mimic the use of "crib sheets." John Carroll has noted that users of office systems frequently have several sheets of frequently used commands, hints, and remedies (9). Try to create P-Forms similar to such quick reference guides.

Resulting Context: One of the most important derivatives of building upon the trainee's prior knowledge is that this makes it possible to highlight novelties by their contrast with a background of familiarities. When new experiences can be nearly interpreted by reference to old experiences, the mismatches can pose questions and guide reasoning. Trainees will be motivated by and attracted to such problems that are manageably discrepant with prior understandings (1). A liability is that experienced users tend to employ a small subset of available functions that they already know, regardless of their efficacy (9), and might not arrive by themselves at an optimal strategy or errorless performance.

Rationale: The term "novice" exposes a technocratic ideology of training that is insulting. Adult trainees can never be thought of as novices, they know about other computing tasks and tools. Failure to utilize prior knowledge is an important contributor to the failure of systematic instruction (1). With a small context adjustment, PPP patterns DIFFERENT EXERCISE LEVELS and ROUND AND DEEP (9) would be useful along with this pattern. INVISIBLE TEACHER (9) has some relevance, though it involves groups and this pattern does not. EXPAND THE KNOWN WORLD (9) is similar in its abstract essence however its solution is not relevant. THREE BEARS has some relevance also (9). Concepts in the Seminars patter

RELEVANT EXAMPLES (10) are relevant to this one. ADAPT TO THE PARTICIPANTS BACKGROUND (10) generally relates to this one as well.

3.9 USING THE SITUATION

Context: The training situation itself can provide many of the details that, with the context preserved, can transmit fairly subtle information. This is similar to the situation with Errors and their pedagogical potential. The underlying ideology of the systems approach to instructional training design is that a grounding in general principles of training and a systematic methodology can eliminate the need to accommodate the fine detail of the trainee's task domain, while failing to engage the trainee and overwhelming them with verbiage that impedes the training process. Instructional training materials often reveal the inappropriateness of their design by capitalized warnings of what not to do, for example the well-worn and quite ineffective warning "DO NOT DO ANYTHING UNTIL YOU HAVE READ EVERYTHING", usually a red flag that the designer is out of touch with the trainee's situation.

Problem: Explicitly defined details devoid of practical context merely add problematic verbiage to instructional material, while the richer resources for training tend to be avoided by systematic instruction (1). Such training material tends to be produced by designers who have no explicit contact with the situation the trainee is actually in.

Forces:

- The training situation is a fragile chain, with dangerous risks of weak links that can break any time.
- Overdesign, elaborating and reinforcing the management and control of trainee activities risk obscuring the overall goal of training.
- Overdesign results in voluminous training material which further impedes meaningful activity.
- Systematic methodology is important to guarantee reliable design results, but it cannot compensate for an inadequate understanding of the trainees and their situation.
- Few other experiences motivate people like errors (1).

Solution: The designer must directly experience the situation the trainee is in, as directly as possible. Go out into the trainee's world and experience the situations you are trying to alter through design. Instead of focusing only on target performance objectives, consider the trainee's experience of the training process. Avoid drill and practice examples, the verbose telling of how to perform skills. Instead show your trainee in context how to participate and give them an opportunity to play with what they are working with (1). For example, develop your P-Form collection iteratively. A single design pass should be avoided, and the trainees should participate in the refinement of the P-Forms. Empirical evaluation by the trainees is very important. Like Agile, testing these P-Forms occurs early in the design process, evaluate with real users, and then refactor the design. When writing the GET THE DATA P-Form, the first draft may be produced by one or two people closest to the training task, tried by the user, reevaluated through feedback in some sort of workshop, and redesigned. Typically the original designer may miss or take for granted certain aspects of the data or database that will only come to light after trial and review by the actual users.

Resulting Context: Trainees will participate and learn fairly subtle information, perhaps after first modeling the tasks through play. This kind of training may provide the curriculum rather than being replaced by the curriculum. . The training designer should know that the material will evolve and improve over time. Clearly there may be skills and concepts too complex for this kind of treatment, however in this kind of training the material will be much more relevant, the trainees more highly motivated, and the training results of higher quality (1). A liability is that since a large part of the material is not standard and cannot be created in advance, this pattern requires more time on the part of the instructor and trainee

Rationale: The training situation itself abounds with rich meanings and experiences, the chance for discovery, the possibility of achievement. Systematic training materials usually contain voluminous information that impedes the training process. Why not explore the natural resources of the training situation (1)? Some of the PPP patterns approach these concepts but do not ask the “designer” of the “training” to go deep into the trainee’s world to generate the training materials. In such a case the designer would be the person creating the curriculum intensely collaborating with the students to develop the curriculum materials. Some patterns like EMBRACE CORRECTION, TEST TUBE, possibly TRY IT YOURSELF, SELF TEST, and ACQUIRE PARTICIPANTS FEEDBACK (9) get into this area but to a far lesser extent than is called for in this pattern. Concepts in the Seminars pattern RELEVANT EXAMPLES (10) are relevant to this one, though RELEVANT EXAMPLES does not involve going deeply into the trainee’s world for collaboration.

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