

# Event-Driven Learning as a Process Improvement Strategy

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*Software and systems engineering tasks, with their well defined development life cycles, can incorporate an effective training option—event-driven learning, which improves performance of development teams by providing training just prior to performing a task. The key to event-driven learning is that training is divided into “chunks” that apply only to the next task in the life-cycle phase. Each chunk of courseware is just long enough to teach the new skill, generally one to four hours in length. Since it is critical that the training is part of the development process and on the project time line, the information chunks are discrete and easy to remember and practice. Workers apply the new concepts and skills quickly, thereby retaining the training. A well designed course has the work-team starting on the task during training. Event-driven learning reduces overall training costs by reducing optimizing costs and increasing course development efficiency. It improves job performance through the immediacy of the training that prepares trainees for the specific task, and the task reinforces training that has just occurred. There is no time for forgetting. Event-driven learning capitalizes on two critical learning characteristics: People are motivated to learn because they need to immediately apply the information; and those learning can relate the information to a functional context provided by their jobs.*

Event-driven learning is a training delivery approach designed for the process-oriented organization. An organization with well defined processes for all, or even part of its business processes, can increase its practitioners' effectiveness. This improves product quality and optimizes training expenditures by designing training experiences directly into the operational process.

In addition, event-driven learning addresses the organization's need to provide satisfactory training to project staff in a cost-effective manner. In today's organizations the appropriate allocation of overhead dollars is critical to the organization's survival. The modern quality frameworks (CMM®, ISO, Baldrige, SPICE, etc.) all stress the importance of training for staff development and job satisfaction. Rapid technology changes also put pressure on organizations to maintain their staffs' skill levels.

Traditional courses that last several days often use valuable resources and do not provide optimal payback. Course registration and trainee time are both high-ticket items, especially with an increasingly fluid technical environment. Corporate expenditures for training experiences must produce ongoing benefits to both the organization and the staff being trained.

Training *experiences* is intended to be an inclusive term. Event-driven learning capitalizes on the dynamics of just-in-time instruction and uses whatever instructional method is most appropriate for the situation. Technology and instructor-based instruction can be effectively used in an event-driven learning strategy. Computer- and Web-based training are becoming per-

vasive in organizations with the availability of large libraries of instructional materials acquired from many vendors and combined with desktop delivery capability.

The realism of video-based instruction for modeling task performance and interactions is made more accessible through improved Web delivery of images. The Web itself is a vast encyclopedia of instructional information on just about any topic. It offers the ability to continuously update and disseminate information and performance enhancement tools.

Electronic performance support systems are embedded in many of the products we use and develop to supply information and training opportunities at precisely the moment during task performance when the training is most required. Instructor-led training certainly has not fallen off the radar screen as an effective instructional delivery method, especially as organizations move to more team-oriented management approaches. And document or electronic job aids provide focused instruction for short procedural tasks.

## The Times Demand Flexibility

The dynamics of our organizations are changing almost as quickly as the technology that both supports them and is frequently part of their products. People move from job to job more readily than ever before in our history. Increased use of telecommuting and more consultants with fewer full-time staff are pressuring organizations to find new ways to maintain high quality levels in their delivered products and services while being responsive to the needs of a changing workforce. Organizational performance manage-

ment systems are providing easier visibility into human resource status within the organization. Stability in organizations is based on the way they perform business and produce products. It is the process-oriented organization that will continue to maintain quality. Meanwhile the structure and human resource characteristic of the organization may change. We have all experienced *flavor of the month* approaches to accomplishing business goals. But across all of these approaches, the common themes define and improve organizational processes and satisfy cognitive, skill, and affective staff needs to maintain organizational health.

Event-driven learning is based on the concept that successful organizations have well-defined processes in place. Organizations that specialize in systems and software development generally base their processes on one of the capability maturity models. Manufacturing and segments of service industries are more likely to use ISO as a framework.

Regardless of the structure, once a process is defined it is imperative that practitioners be trained in performing the process. Successful organizations integrate learning and work since rapid organizational and technological changes require that training and production must take place concurrently. In this model training has two primary goals:

- For individuals to acquire the skills and behaviors necessary to effectively execute the process.
- To institutionalize how processes are performed and standards implemented across the organization.

Event-driven learning optimizes goal

achievement by integrating the training and work process model, tying the training episodes to specific events in the process model.

## Engineering Framework Integration

Defining an organization's implementation of an engineering framework (software or systems) generally consists of documenting organizational standards, processes, and procedures (work instructions). Entry criteria, inputs, activities, output, and exit criteria are documented, and roles and responsibilities are assigned. This may be a top-down process: A group within the organization defines the processes and pushes them down in the organization. Or it may be bottom up: Best practices are culled from existing processes. Usually, the institutionalization of processes is a combination of approaches where existing processes are refined by a central group and disseminated. The group also fills in gaps where the existing processes are not consistent with the selected framework.

Typically training is offered at the process area level. For example, a *Procedures for Deriving and Allocating Requirements* course may be offered. Event-driven learning breaks this larger body of material into chunks that are directly related to the activities performed in the process area, and offers training experiences that enable practitioners to perform the specific activities in the next process step. The training events build into a complete support system for long-term individual and organizational performance as the workers execute progressive activities in the overall process. Figure 1 is an example of a high-level process diagram for requirements analysis showing several courses being integrated at appropriate points in the process.

**Course 1 – Requirements Management Process.** This is a facilitated discussion of the organization's process for managing requirements. It presents the underlying importance of requirements management to the program's success and walks participants through the process step by step. As each activity in the process is presented, participants discuss how the activity will be instantiated in their program. This course generally takes one to two hours depending on the participants

experience and the program complexity.

**Course 2 – How to Facilitate Requirements Gathering Meetings.** This is a workshop where participants learn how to extract functional information from customers and end-users in a meeting format, then document the functional requirements and verify them with the user. Interpersonal and documentation techniques are taught. Each participant gets the opportunity to practice the new skills in the workshop setting. Since people are asked to role-play extensively in this course it generally takes about three to four hours for six to eight people. It is administered immediately prior to the requirements analysts going into the requirements gathering meetings. If other requirements gathering techniques are used, such as task analysis or reverse engineering an existing system, then courses appropriate to those techniques would be offered at this point in the process.

**Course 3 – How to Write Requirements.** This course focuses simply on the format and content of a well written requirement. The importance of well written requirements is explained and rules for the structure and content of the requirements are presented; templates and checklists are provided. The participants are engaged in exercises where they identify well and poorly written requirements and then write and critique requirements. This course lasts about one to two hours and is most effective when the customer is included as a participant.

**Course 4 – How to Conduct a Requirements Walk-Through.** This is a simulation-based course where walk-through participants practice the dynamics of the walk-through session consistently counting defects according to the rules laid out by quality assurance. The walk-through simulation lasts about half an hour for a five-person team. If a formal inspection technique is used at this point in the process, then the training takes about four hours for up to six participants, as each has the opportunity to practice the roles in the inspection. The checklists and templates from the previous course are used in the walk-through and inspections courses.

**Course 5 – Interpreting the Software Requirements Specification (SRS) Standard.** This course walks the partici-

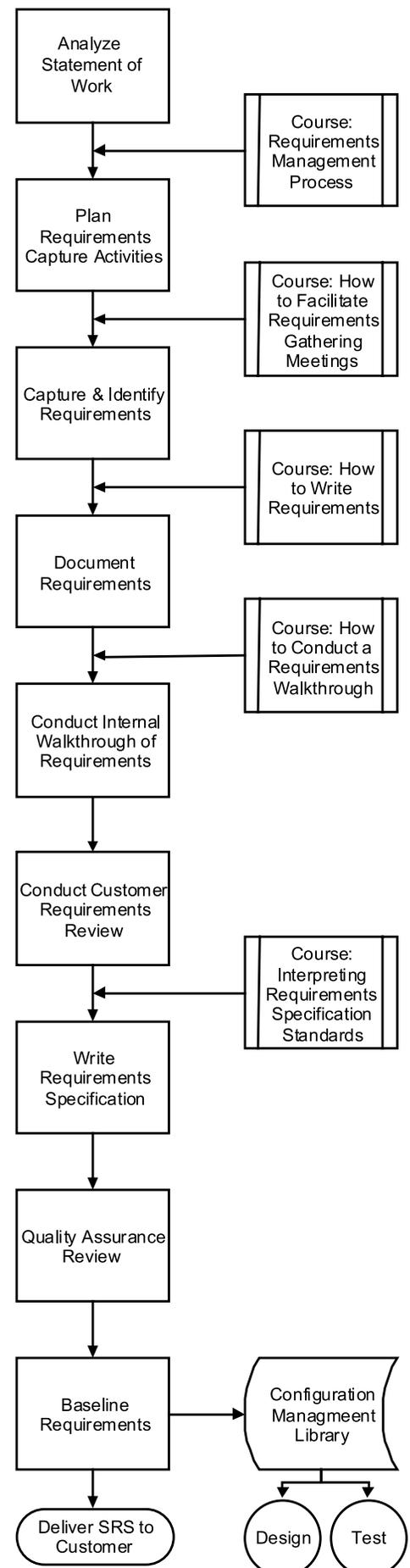


Figure 1. Event-driven learning courses support specific activities in process models.

pants through the standard (data item description) for the requirements specification before a word of the document is written. A quality assurance analyst, who will be reviewing the document when it is produced, most effectively teaches this course. Expectations for the content of each (sub)paragraph are discussed so that the author(s) is ready to write a compliant document. This course generally takes about 15 to 30 minutes.

These five courses are examples of applying event-driven learning to the requirements development practice area. Typical requirements courses are advertised as three-day courses and generally cover the same instructional objectives as the five event-driven learning courses cited above. Course objectives for a commercially available three-day *Writing Testable Requirements* course are:

- Techniques to produce requirements documents that are concise, accurate, modular, and highly testable.
- How to identify and correct ambiguities in specifications.
- How to ensure that your requirements documents conform to standard industry guidelines.

These sound like a subset of what is accomplished in the nine to 12 hours of event-driven learning training described above. Because the learner in a multi-day course is often weeks away from putting all the techniques learned in the course into practice, training time needs to be extended to account for additional in-course exercises so that skills are ingrained. Conversely, event-driven learning with its process activity-focused *chunking* approach allows the learner to start practicing the new skills or applying the new knowledge within hours. It also makes it easier to change the instructional delivery method to better suit the content, audience, and logistics of the topic being learned.

Event-driven learning is also a useful approach when a particular concept is frequently misunderstood yet easily clarified with a brief training experience. Work breakdown structure (WBS) is an example of such a topic. When asked to produce a WBS for a program management plan, practitioners frequently produce a Gantt Chart of activities: an hour-and-a-half training session on producing WBS results in a valid WBS supported by

activities. The workshop format evolved from trying to solve the problem by publishing job aids. When that did not get the desired results, a classroom setting was used that explains the differences between WBS and Gantt. It gives the participants a chance to derive and critique WBS for some everyday situations. Other activities in performing program planning are addressed by additional event-driven learning courses similar in concept to the courses described for requirements definition.

A commercially available, Web-based management training product also applies the event-driven learning concept. Each of the training experiences in the curriculum address a single management situation. In this case the event is a manager/staff-member interaction on a particular topic, such as excessive tardiness, perception of insufficient raise, correcting bad personal habits, etc. The just-in-time concept used in this event-driven learning experience is that just before the manager has such an interaction with a staff member, the manager would review the guidelines for conducting such an interaction. With the instruction and modeled behavior fresh in the manager's mind, the interaction proceeds more effectively and the desired results are achieved.

## The Development Process

Event-driven learning development follows a typical instruction systems development approach. The event-driven learning development process is initiated after the work processes have been defined. Once this is done, the training needs are determined. Training needs should be prioritized so that the process with the greatest impact on the program is the initial candidate for event-driven learning support. Impact may be derived based on cost, criticality, risk, complexity, and other dimensions relevant to the project. Once these initial processes are chosen an event-driven learning training plan is developed that identifies goals, scope, concept of operations, general approaches, target learner audience, resources, schedule, and other information necessary to accomplish the training within the organization or program's operational constraints.

Decomposition of the process model down to the work-instruction/procedural

level helps to define the abilities the learners will need to possess when they complete the training. Analysis of standards and output descriptions for the process steps is also needed at this point. The analysis results are translated into instructional objectives that describe the training outcomes by using terms that complete the phrase, "At the conclusion of the course the learner will be able to ...."

With the instructional objectives and training plan in hand, the event-driven learning experience can be designed. Grouping the objectives into meaningful, complete, stand-alone groupings defines the chunks of training to be offered. The decomposed process models define when the training courses are to be inserted into the process area. The nature of the work performed and the logistics of the work environment will help determine the instructional delivery method used. Since event-driven learning is so focused on the next task in the work process, event-driven learning design starts with designing the practice exercises that the learner will perform during the course. The underlying premise is simply that people best learn by doing. These hands-on experiences during training are designed to transfer directly to the work instructions on the job.

Using actual work samples and outputs from previous process steps as examples (of both good and bad instances) makes the training most relevant. Small, focused chunks of training are developed at a time, so it is easier to customize each instance of the course for the target audience. If the program is at a stage where relevant work products are not available, or the class is a mix of students from several programs, current events often provide a rich, timely source of material for exercises.

All event-driven learning courses must be formatively evaluated before being implemented. Peer reviews are a useful technique for an initial evaluation. A dry run is then suggested to verify that the course produces the expected outcomes. For technology-based event-driven learning, both the logic and the content of the course must be evaluated. It is also a good idea to verify the logistics of delivering the course regardless of the delivery mechanism. Once the course is positively evaluated, the process model is updated to

## Benefits of Event-Driven Learning

Event-driven learning provides many benefits to the organization. These benefits positively affect customer satisfaction and the organizational bottom line. Some of the direct benefits are:

- **Increased training efficiency** – Because process support training is more focused on steps within the organizational processes rather than being designed to address a broader scope, limited resources are expended to generate the appropriate training. Fewer total training hours are required to achieve the instructional objectives; so if the resources are held constant, more objectives can be achieved by the trainees.
- **Increased training effectiveness** – Trainees remember the things that they practiced the most and learned last in a class. Information overload during training often results in new information never being consolidated by learners during the instructional session. Information presented in small, retainable chunks is quickly applied in a work context that reinforces the learning experience. Because the training session takes place during the implementation of a work process, the learner better perceives the daily relevance of the information and skills being taught and is therefore intrinsically motivated to learn.
- **Positive opportunity costs** – The short courses that are characteristic of event-driven learning are usually taught in-house, rather than sending people off-site. In addition to reduced administrative costs for the delivery of the courses, the trainees are more available for their regular jobs thus improving the opportunity cost picture.
- **Reduced rework/revision costs** – One of the underlying concepts of event-driven learning is that people generally like doing things correctly and hate going back and redoing things. With a training event properly scheduled just before an activity is undertaken, the workers will learn a skill and immediately put it into practice thus increasing the likelihood that they will get it right the first time. Also, the training design often incorporates checklists and other job aids as handouts (electronic or physical) that reinforce training concepts and facilitate correct job performance. Using event-driven learning for team training enables the entire team to better coordinate their activities, assure a common focus, and reduce wasted effort.
- **Modifiable and maintainable courseware** – Because of their relatively small size event-driven learning courses are easy to modify and maintain. Most processes evolve over time rather than undergo major, revolutionary changes. Part of the process change control activity should be modifying any event-driven learning course associated with the process. Event-driven learning is a key component for an organization intent on continuous learning and change because of the relative ease with which it can be modified.
- **Institutionalization of processes** – Using the same course materials to teach people in an organization how to perform specific activities within the organization's processes assures that they are performed similarly across the organization. People will practice performing the activity during training, increasing the likelihood that they will perform it correctly on the job. As each group in the organization takes the training and gets feedback on how well they are applying the new skills in their work, the institutionalization of the process takes place without resistance.
- **Quick fix process improvement strategy** – In the event that particular process steps are consistently not performed correctly, event-driven learning training experiences can be inserted in the process fairly quickly. Assuming 20 hours of development for one hour of instruction, a typical event-driven learning course can be available within a week or two to address the process issue(s).

include the course at the appropriate point in the process. Thus, whenever the work process is performed, the training occurs at a time when it can have the most impact on the successful completion of the process.

Event-driven learning is a flexible approach to improving the performance of processes within an organization. Regardless of the framework used to guide system and software development efforts, small, relevant, integrated training experiences enhance people's ability to correctly perform process steps and adhere to program standards.

### Summary

Event-driven learning is an approach for satisfying training needs in a process-based development environment that optimizes job performance and thereby product quality. The technique for defining and developing event-driven learning is a combination of a systematic approach, experientially educated guesses, and analysis of actual performance data. During process definition activities an analyst identifies products (outputs) and activities (process steps) that are new, unique, or complex. Other factors may relate to criticality of the product and frequency of performance of the activity (low frequency activities may need to be retrained prior to performance). These process steps are then

candidates for being supported by event-driven learning courses.

Alternatively, data from previous performance of the process may indicate that a particular activity in the process is being poorly performed (takes too long, too many errors, has to be redone several times, etc.), or the products from the activity consistently show a large number of defects. In either of these conditions, event-driven learning is a proactive method for process improvement. Once the need has been established, the process model is changed to include the course at the appropriate step in the process, and an instructional systems development process results in implementing the training.

The primary reasons for using event-driven learning in your organization are:

- Event-driven learning is a cost-effective approach to software and system engineering training that improves organizational process performance.
- Applying newly learned skills immediately after training reinforces the learners' training experience and reduces overall training time and forgetting.
- Event-driven learning capitalizes on adult learning principles regarding focus on real world application and retention of new information and skills.
- Event-driven learning can focus on satisfying job performance needs of the individual or a team.

Everyone benefits from using event-driven learning as a process improvement strategy. The organization improves its process control and maintenance methods and institutionalizes processes and standards. The individual is given the skills to achieve greater job satisfaction and thereby higher morale. Teams achieve greater cooperation and cohesiveness. And the customer acquires a higher quality product because the process that produces the product is better performed and managed. ♦

### About the Author



**Michael J. Hillelsohn** is a director of Product Assurance at Software Performance Systems (SPS) in Arlington, Va. SPS builds secure e-commerce, case management, and network solutions for government and industry clients. Hillelsohn is a certified quality professional with more than 30 years of experience doing development, management and performance improvement in software and systems development environments. His multidisciplinary approach combines quality systems and training expertise to improve the performance of organizations and individuals. His process-oriented, performance engineering methods facilitate adoption of external frameworks (CMM®, ISO, Baldrige) to improve the quality of organizational products and services.

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### Kudos for CrossTalk

I have used back issues of CROSS TALK often in my software process improvement work both at Xerox and Hughes. It is really helpful! – **Delores J. Harralson**

I'm having withdrawal ... not having CROSS TALK to read since I left Puget Sound Naval Shipyard! The hard copy will be perfect to read on Metro on my way to and from work! – **Cathy Ricketts**

Some time ago I noticed the change in your cover for CROSS TALK, I thought at the time, what a nice change. The colored, more graphic cover adds dimension and class to your publication. I felt at the time and still do the change was an improvement. I also find the articles informative and interesting. I work in the communications industry (Quest) in support of Information Management System (IMS, IBM mainframe software) and find information that relates to my work environment. The publication also gives me a look at other perspectives. Good job! – **Kevin Mauchley**

### Modeling and Simulation Web Sites

[www.ist.ucf.edu](http://www.ist.ucf.edu)

The Institute for Simulation & Training is an internationally recognized research institute that focuses on advancing modeling and simulation technology and increasing understanding of simulation's role in training and education. Founded in 1982 as a research unit of the University of Central Florida and reporting directly to the vice president for Research, the institute provides a wide range of research and information services for the modeling, simulation, and training community.

[www.msiac.dmsomil](http://www.msiac.dmsomil)

The Modeling and Simulation Information Analysis Center assists the Department of Defense (DoD) in meeting their modeling and simulation needs by providing scientific, technical, and operational support information and services. MSIAC is a DoD Information Analysis Center, sponsored by the Defense Technical Information Center and the Defense Modeling and Simulation Office.

[www.scs.org](http://www.scs.org)

The Society for Computer Simulation (SCS) International is the principal technical society devoted to the advancement of simulation and allied computer arts in all fields. The purpose of the society is to facilitate communication among professionals in the field of simulation. To this end, the society organizes meetings of regional councils, sponsors and cosponsors national and international conferences, and publishes the monthly journal *Simulation* as well as the quarterly journal *Transactions* of the SCS.

[www.ecst.csuchico.edu/~mcleod](http://www.ecst.csuchico.edu/~mcleod)

The McLeod Institute of Simulation Sciences was established in 1986 at California University, Chico, to be a center of excellence in computer modeling and simulation as a collaborative effort between the university and the Society for Computer Simulation International. In creating the institute, the university recognized a unique opportunity to develop a widely-recognized center engaging in state-of-the-art simulation research and educational activities by virtue of a critical mass of experienced faculty available to contribute to this effort. The institute provides a mechanism through which faculty from various disciplines and their students and associates can bring their talents to bear in the general area of computer simulation or can seek help with the application of simulation to new areas.

[www.vmasc.odu.edu/main.htm](http://www.vmasc.odu.edu/main.htm)

The Virginia Modeling, Analysis and Simulation Center is a cooperative venture between business, government, and academia whose purpose is to promote economic development through application of computer simulation. It is administered by the College of Engineering and Technology, Old Dominion University, the Department of Defense, the state of Virginia, and Suffolk City. The center consists of a consortium of universities working cooperatively to advance business applications of simulation technology, and to transfer new simulation technology developments between defense and civilian organizations.

[www.rta.nato.int/msg.htm](http://www.rta.nato.int/msg.htm)

The Modeling and Simulation Group provides readily available, flexible and cost-effective means to dramatically enhance NATO operations in the application areas of defense planning, operational planning, training and exercises, and support to operations and modernization. This goal will be accomplished by a NATO-wide cooperative effort that promotes interoperability, reuse and affordability.

