Developing employee expertise through structured on-the-job training (S-OJT): an introduction to this training approach and the KNPC experience

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Abstract

Purpose – *This paper aims to describe how structured on-the-job training (S-OJT) was implemented to develop new-hire engineers at the Kuwait National Petroleum Company.*

Design/methodology/approach – *The paper describes a case study on the development, implementation, and evaluation results of an extensive case study in an organization.*

Findings – *The results show a reduction in development time and increased confidence in the skills of the new-hire engineers, among other outcomes reported.*

Practical implications – *The case study can assist other advanced training and human resource development practitioners to develop high-skilled technical employees who may require different approaches to ensure a depth of conceptual and job-related information.*

Originality/value – *The intent of the case study is to assist other advanced training and human resource development practitioners in developing high-skilled technical employees. Such employees require different approaches to ensure a depth of conceptual and job-related information. The case study shows how one organization addressed this issue.*

Keywords *Structured on-the-job training, Employee competence, High-skilled training, Engineer development, Job analysis, Workplace training, Training, Employees*

Paper type *Case study*

The classroom has been the preferred location for most training programs in companies. But the reality is that employees learn most of their knowledge and skills in the work setting while actually doing their jobs. How to develop and implement effective on-the-job training programs, or structured on-the-job training (S-OJT), is a continuing challenge for many organizations and, in particular, for human resource staff members.

This paper has the following goals. First, it will discuss employee competence in the workplace, which is the context for understanding S-OJT. Next, the paper will define and describe what is meant by S-OJT, based on over two decades of research and development activities. Then, it will describe the KNPC experience in using S-OJT as the primary means to develop newly-hired engineers in their refineries, including an initial reporting of some outcomes of this initiative including the reduction in development time. Finally, the paper will discuss the practical lessons learned from the KNPC experience.

Employee competence

Ensuring that employees have the competence to meet current and future work expectations is an especially critical issue for managers today. As a result, more and more organizations have adopted training approaches such as S-OJT (Jacobs, 2003).

> **“S-OJT is defined as the planned process of having experienced employees train novice employees on units of work in the actual work setting.”**

S-OJT

S-OJT was originally introduced in the 1980s to help organizations respond to new demands for greater levels of quality and productivity. Many of the same fundamental issues exist in organizations today. Recent advances have greatly expanded how S-OJT is being used across a range of organizational settings and in combination with other training approaches. S-OJT is defined as the planned process of having experienced employees train novice employees on units of work in the actual work setting (Jacobs, 2003). From this definition, S-OJT benefits from providing a greater degree of predictability in the training outcomes, and from being conducted mostly by experienced employees.

From a practical perspective, S-OJT offers some apparent advantages for managers because the training might be conducted when the employee need arises and without demanding any special resources from the organization, such as a classroom internet connection. Of particular relevance to S-OJT is the understanding that the match between the learning setting and the work setting for facilitates the transfer of training (Jacobs, 2003). Since S-OJT is conducted in the work setting, or a setting that approximates the features of the work setting, and managers or supervisors often serve as trainers, the need to address transfer of training as a specific issue appears to be less critical. The characteristics of S-OJT inherently address transfer of training issues that would otherwise require attention if some other training approach might be used.

Facilitating the understanding of S-OJT is to view it as a type of training system (Jacobs, 2003). Similar to all training systems, a system view includes the inputs, processes, outputs, and the context of the system in relation to other systems. The S-OJT system shows that the inputs are comprised of the novice employee, or trainee, who is expected to have the motivation and readiness for the training. The experienced employee serves as the trainer and who is expected to have sufficient knowledge of the task and is qualified by the organization to deliver the training.

The training location identifies the criteria for selecting the exact location of the training. Often times, S-OJT is intended to be conducted in the work setting, but there are constraints that do not allow this to occur as planned, so an alternative setting needs to be identified without sacrificing the critical attributes of the work setting. The work to be learned is the unit of work that is being presented in the training, as represented by a training module format. S-OJT modules do not present an entire job per se, but only a defined task, assignment, or project that the trainee is expected to perform. Finally, the inputs include whatever communications technology that may be necessary to manage or even help deliver the training. More and more S-OJT programs are relying on some use of technology because the trainee and trainer may not be in the same location.

The processes include the activities that are done for the trainer to get ready to train, the training events used by the trainer when actually delivering the training, and the means used, such as performance ratings, follow-up observations, and periodic feedback, to ensure that the trainee has learned the content.

The outputs of the S-OJT system are the results that occur in terms of accomplishing the training objectives, the impacts on the work, and the contribution that the training makes to the individual’s own development progress. Finally, the organizational context includes the factors in the work setting that facilitate or constrain the system’s components, such as the resources – time, people, and equipment – allotted to the training.

As shown in Figure 1, viewing S-OJT as a system is practical. The components show what needs to be attended to when developing such a system. And, the components also guide troubleshooting when seeking to improve the system once it is implemented.

Numerous examples of S-OJT programs have been reported in the literature. Table I presents a listing of published S-OJT case studies. Table I identifies the organization, the job-level involved, and the reported results.

Regardless of the context, the various S-OJT case studies have some aspects in common. The training is conducted in the work setting not a classroom or some other formal setting. The training is delivered either by an experienced peer employee or manager. The training is accompanied by a set of materials that document the unit of work being presented during the training. Finally, the training connects to a large extent with specific work expectations.

Research on S-OJT is just in an emerging status. Arguably, the first research study related to the effectiveness of OJT was the Lens Grinder Study (Dooley, 1945; Reprinted in Jacobs, 2003) that was conducted in 1941. The study sought to establish the effectiveness of a planned approach to training on the job. The results showed that the length of time to train apprentice lens grinders could be reduced from five years to six months. The Lens Grinder

Figure 1 Display of the S-OJT system

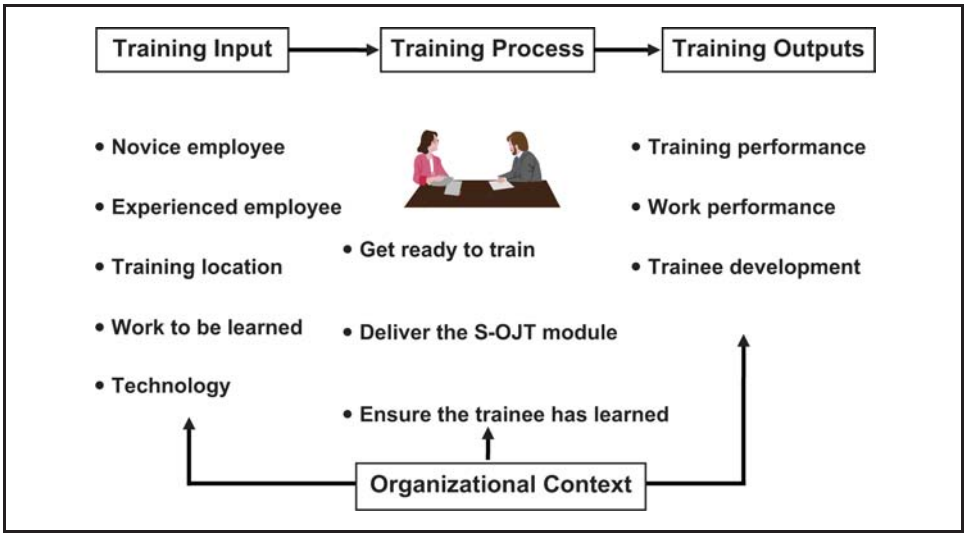


Table I Case study companies, job levels affected, and results of using S-OJT

Organization	*Job level*	*Results*
GM – US	Operators Supervisors	Reduced the number of wiring errors, implement JIT system
Truck company	Production Technicians	Reduced the number of leaky windshields
KLM	Cabin attendants	Provided more relevant customer service training experience
Regional hospital –US	New supervisors	Provided information about the mission and vision faster
Large utility	Supervisors	Reduced the number of back injuries among production employees
Apple Computer	Skilled assemblers	Reduced training time, fewer assembly errors
Seagate – Singapore	Production	Reduced number of inspection errors
Pharmaceutical	New-hire lab techs	Reduced time required to complete job rotations
Abbott Diagnostics Division	Lab technicians	Meet ISO and FDA requirements

> **"S-OJT takes less time to conduct and achieve the objectives when compared to unstructured OJT, classroom training, and blended versions of the training."**

Study was reported as part of the final report authored by Channing Rice Dooley, as he was closing the Training Within Industry (TWI) project during the last months of the Second World War. Most observers suggest that the TWI project influenced much of current understandings of S-OJT.

Much of the early research on S-OJT focused on determining the financial benefits of S-OJT (Jacobs and McGiffin, 1987; Jacobs 2002a, b, 2005). Two areas of focus came from these various studies: training efficiency and training effectiveness. Training efficiency addresses the question whether S-OJT took less time to deliver and whether the investment made to reduce the training time was more or less than the value of the outcome of the training. In general, the results related to training efficiency suggest that S-OJT takes less time to conduct and achieve the objectives when compared to unstructured OJT, classroom training, and blended versions of the training. In addition, the results suggest that the reduction in training time is accompanied by greater financial benefits. The proportion of the time savings and the financial benefits depend on the individual situations.

Training effectiveness addresses the question whether S-OJT leads to better training outcomes when compared to other training approaches and whether the investment to achieve those training outcomes results in financial benefits in terms of improved work outcomes. An illustrative study in this regard was reported by Jacobs (2003), who compared the value of the work defects (leaks found in windshields in a truck assembly plant) when employees had received unstructured buddy training and S-OJT. The results are reported in the cost of defects reduced when using S-OJT, but also taking into consideration the cost of the training.

KNPC experience

Kuwait National Petroleum Company (KNPC) is a subsidiary of Kuwait Petroleum Corporation (KPC). KNPC was established in 1960 as a shareholder company owned by the government and private sector. In 1968, the company commissioned its first refinery and in the May of that year the first shipment of refined petroleum products was exported. In 1975, KNPC became a wholly owned state company. After the establishment of KPC in 1980, KNPC became wholly owned by KPC, which itself is owned by the state of Kuwait. KNPC was specifically entrusted with the responsibilities of oil refining and gas liquefaction as well as with the distribution of petroleum products to the local economy. KNPC now has three refineries in addition to a liquid petroleum gas plant. Most of the facilities suffered severe damage during the Iraqi invasion, but the repair and restoration program was completed by the end of the 1993-1994 fiscal year.

As an ongoing policy, KNPC seeks to maximize its employment of Kuwaiti nationals among its approximately 6,000 employees. Each year it hires approximately 100 recently graduated engineers to replace retirees, account for expansion, and continue local employment Kuwaiti nationals. In 1999, faced with the challenges of increasing productivity, maintaining international safety and quality standards, and reducing turnover among the skilled workforce, KNPC conducted a large-scale analysis to determine the skills and competencies of engineers in selected departments. The study showed the following results:

- Existing efforts to develop engineers lacked a suitable structure and were inconsistent across the refineries.
- No competency inventory existed to identify the expectations of newly-hired engineers.

- Most training occurred off-the-job in a classroom setting, focusing on background information rather than on specific job information.
- No management accountability system existed to ensure that new-hires actually were trained and there was any documentation of that training.
- Workloads of experienced engineers were assigned without taking into consideration that these individuals might be training the new-hire engineers, if only in an unstructured manner.

In 2001, S-OJT was selected as the basis for addressing these flaws in the current way that new-hire engineers were developed (Al-Muzaini *et al.*, 2002). In 2002, a total of 31 engineering specialities were identified to be included in the project. An external consultant, Ronald L. Jacobs, was asked to help guide in the development of the first eight disciplines. The process used for the project was in conformance with the ISO 10015 Guidelines for Training standard. The following briefly discusses each of the major phases of the project.

1. Conduct an analysis of the engineering disciplines

The first major phase of the project was to analyze the duties and tasks of all 31 of the engineering specialties or disciplines. This was done through a process called DACUM (Developing a Curriculum). In 2002, two KNPC staff members, Mr Mohammad J. Bu-Rahmah and Mr. Yacoub Al-Tarrah, were trained on the DACUM process and they undertook the task of facilitating the process with oversight by the consultant. This phase resulted in documents in spreadsheet format showing the tasks that comprise each duty for each engineering discipline. Figure 2 shows how this information was presented for each duty.

2. Identify the duties and tasks appropriate for S-OJT

After the duties and tasks were identified and confirmed by the subject-matter experts, the duties and tasks appropriate for inclusion in the S-OJT project were identified. For example, some duties were common across all specialties, so they were not included in the project. And some tasks were determined that they could be learned through experience or some other training or educational approach. In some instances, certain tasks were combined with related tasks to comprise one task.

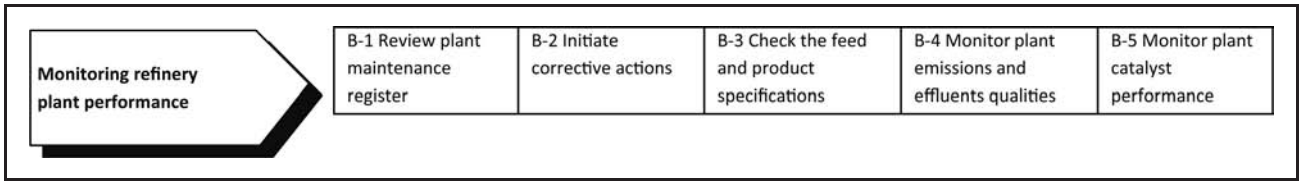
3. Analyze the tasks within each duty

Subject-matter experts (SMEs) were identified for each of the disciplines, and then they were trained but the consultant on how to analyze the tasks that were identified as being appropriate for the project. In some instances, more than one SME was used. SMEs were experienced engineers who were loaned to the project for a short period of time. In all instances, the completed task analysis documents were thoroughly reviewed by the consultant, the training staff, managers and team leaders, and other qualified SMEs. A continuous revision process ensured that the task analysis documents represented the most accurate, most complete, and most logical understanding of that work.

4. Prepare the S-OJT modules

The modules were comprehensive booklets that represented the work at the duty level. Thus, for each discipline there are several modules. In turn, each module contains all the tasks for the duty. For instance, the following shows the titles of the modules for the process engineer discipline. Then the tasks from Module A are listed:

Figure 2 Example job duty and associated job tasks



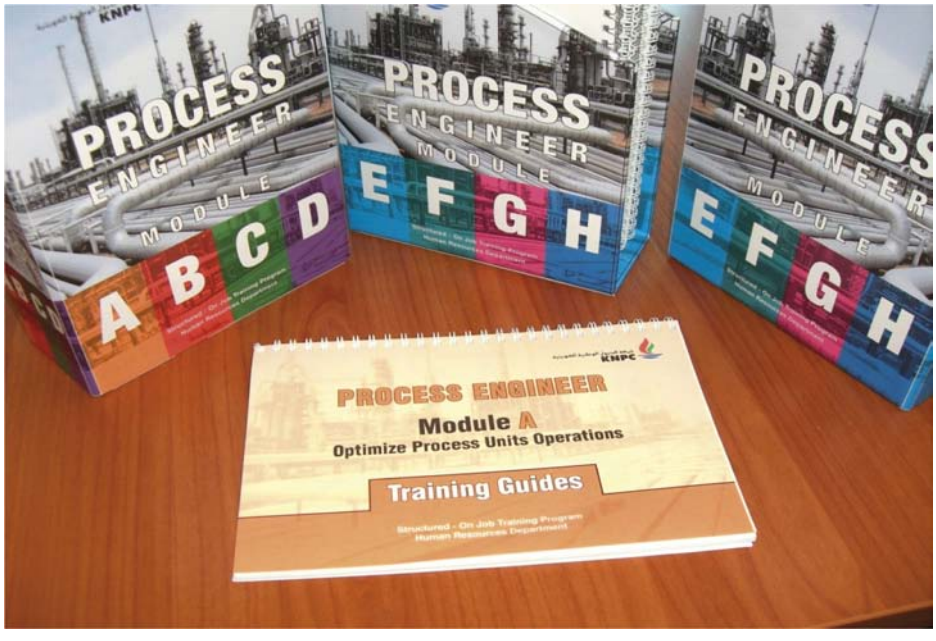
1. *Process engineer*:
   - Module A – optimize process units operations.
   - Module B – maintain process units operations.
   - Module C – manage process unit performance.
   - Module D – manage project activities.
   - Module E – evaluate process unit performance.
2. *Module A*:
   - A-1 – optimize process units' process yield.
   - A-2 – optimize process units' chemical consumption.
   - A-3 – optimize process units' catalyst consumption.
   - A-4 – optimize process units' utilities consumption.
   - A-5 – optimize water consumption.
   - A-6 – integrate process units' activities with other units.

Plate 1 shows the booklet size of the S-OJT modules that was determined to be best for the current situation:

Each S-OJT module contains the following information:

- Description of the discipline.
- Description of the learning process.
- Necessary training and education courses for the discipline and the module.
- General and specific safety information.
- Resources required to perform each task.
- S-OJT Scorecard that tracks the trainee's progress through the module.
- Training guide that presents specific information on how to perform the task.

Plate 1 S-OJT training guide and boxes containing additional training guides



- Performance Check to ensure that the trainee has learned the task.
- S-OJT Activity Log completed by the trainee to document the completion of each component of the training guide.

5. Ensure management understanding and commitment

Even though the program had complete management support from the beginning, there was a need to begin to share specific information with all levels of management across the refineries. This was done to ensure management understanding of the program components. As such, a series of meetings was scheduled at the refinery locations with senior managers, team leaders, mentors, and checkers. In addition, meetings were scheduled with newly-hired engineers to ensure their understanding of the program and to help them transition to the new development approach.

These meetings were facilitated by the consultant and training staff. Among the activities completed during this phase was the development of a two-page brochure to communicate the project to a broader audience. This information served to inform others, both internal and external to the organization, the nature of the program.

6. Develop the mentors and checkers

The S-OJT program is being delivered by experienced engineers within the context of the work days called mentors. Mentors introduce the modules to trainees, discuss the training content, review and discuss any questions about the task, and complete the Performance Check. Checkers are also experienced engineers, but their role is to meet with trainees to ensure that the trainee has learned the task and to review the Activity Guide. Upon completion of this process, the trainee can move to the next task in the module. Both mentors and checkers receive an extensive program to ensure they are qualified to serve in these roles.

Approximately 300 engineers have been qualified as a mentor and checker. It is desired that all engineers under this process, KNPC has a goal to certify all qualified engineers as mentors and checkers. Specific criteria for inclusion as a mentor or checker are the following:

- *Competence in the work*. Engineers should be recognized for their knowledge and skills in the discipline – but it may not be the entire discipline, but the specific job duty. Not every person can be an expert on all aspects of a discipline.
- *Specialized training and education*. Engineers may have attended formal training and education programs related to the discipline which would be helpful in helping others acquire information about the discipline.
- *Willingness to share*. Engineers should have a personal orientation of wanting to provide information to others.
- *Communication skills*. English language speaking and writing skills are mandatory.
- *Experience/interest in training*. Engineers should have some previous experience or interest in training or being part of a training project.

The program for mentors and checkers conducted over two days. The program includes video clips to illustrate the five steps required to deliver the information in the S-OJT modules and opportunities for practice and feedback from the facilitator.

7. Evaluate and improve the system

The S-OJT program has been in full implementation for all 31 disciplines for approximately one year. Some disciplines have been implemented for a somewhat longer period of time. Because of the extent of the program, evaluation data are now just beginning to be gathered.

During the time of submitting this paper, surveys are being distributed to newly-hired engineers who are in the program, to mentors and checkers, and to managers and team leaders. The survey instruments requests their reactions to the following issues:

- Number of hours spent each week involved in the program.
- Usefulness of the program components.
- Ways that the program could be improved.
- Overall perceptions of the effectiveness of the program.

Of critical importance for KNPC is the question whether the program has reduced the time required to develop newly-hired engineers. An analysis of the human resources data base showed that before the S-OJT program, an average of 53 months was required to advance a newly-hired engineer from a Grade Level 12 to a Grade Level 15, across the eight major disciplines. That is, nearly five years of non-productive learning time. At the Grade Level 15, engineers are said to be fully functioning in that they have sign-off and approval authority on certain design and maintenance tasks.

At the same time, many newly-hired engineers have often viewed this length of time as being a waste of time and has discouraged some to the extent that they leave KNPC seeking better development opportunities elsewhere in Kuwait and in the region.

Initial results of the S-OJT program are showing the following:

- Newly-hired engineers have expressed their appreciation for the program since they recognized that it represents a major planned investment by KNPC in their development.
- Mentors have expressed their satisfaction with the S-OJT modules, especially the training guides, as they contain the content on what they need to present to the trainees.
- Early progress of trainees suggests that development time has been reduced to 36 months, which also includes several months of leave time. Further reductions in development time are expected as the various stakeholders become more accustomed to the program.

Lessons learned

We wish to share the following lessons learned for consideration:

- In the context of how organizations have used S-OJT, this project had at least two unique aspects. First, the project focused on entire jobs instead of specific tasks within a job. Second, the type of job was a professional position, which had not been addressed in previous S-OJT projects. We did not realize the importance of these aspects at the beginning, but they made the project all the more challenging. We now have templates and an understanding how to address these aspects in the future.
- For organizations considering a similar project, it might be advisable to conduct a pilot project first. In that way, the organization could help the various stakeholders understand what is being planned. For instance, while the HR staff may be the primary clients, there are numerous issues that need to be considered along the way and decisions made to help make the project a success. Also, managers need to understand more fully the resource requirements of the program, especially during the development and implementation phases.
- The S-OJT project required the development of HR staff competence. This issue was made more important given the preferred role of the consultant. Specifically, the consultant and KNPC agreed that the consultant and his team would complete eight disciplines, with the internal staff being trained along the way to complete the remaining disciplines. In addition, the consultant assisted the HR staff in developing skills in the DACUM process. To have staff development as a project outcome can be viewed from two perspectives. On the one hand, this approach may be viewed as placing an added burden on already busy HR professionals. On the other hand, this approach may be better viewed as an opportunity to carry advance in the HR profession and to acquire new skills. In addition, such an approach makes the company less dependent in the future on the consultant.

- All individuals involved came to realize the need for a continuing commitment of time, finances, and staffing to complete the program. This was especially apparent when subject-matter experts were asked to participate in the task analysis while developing the S-OJT modules. Of course, it can be expected that refinery management might be hesitant to allow some of their most knowledgeable engineers to work off-the-job to participate in this activity. However, managers should keep in mind the potential long-term benefits of the program. That is, in the future, they might not have such lean staffing levels once the S-OJT program is underway. And HR staff should prepare as much as possible to ensure that the experienced engineers' time will be used as effectively and efficiently as possible.
- Finally, we learned again the importance to support any HR project based on its potential to contribute to tangible organizational benefits. That is, while the S-OJT project has some intrinsic interest from an HR perspective, the project must be justified through its potential to help improve organizational performance. And these outcomes must be of value and tangible so that a return on investment calculation might be done both before the project is started and after the program is implemented.

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