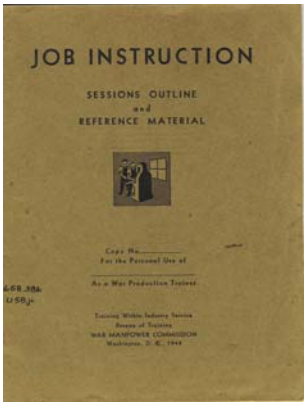
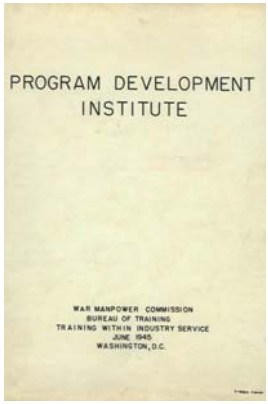
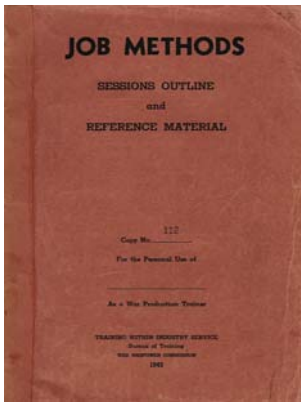
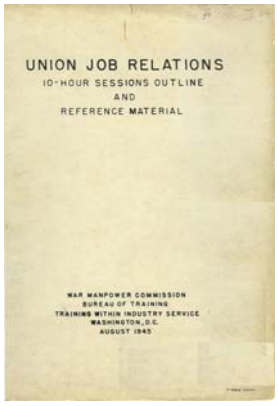
The Roots of Lean

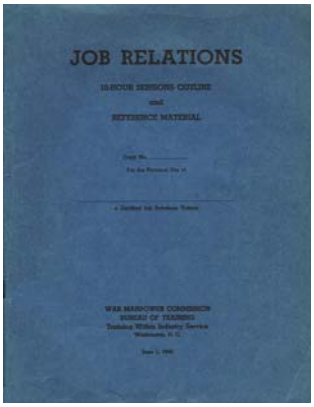
Training Within Industry: The Origin of Japanese Management and Kaizen











Jim Huntzinger

TABLE OF CONTENTS

TABLE OF FIGURES

ABSTRACT

The Training Within Industry Service (TWI) was established in 1940 during World War II to increase production output to support the Allied Forces war effort. The TWI Service was lead by the Four Horsemen, as they became known during WWII: Channing Rice Dooley, director of the TWI Service; Walter Dietz, associate director; Mike Kane, assistant director; and William Conover, assistant director. Three of the four men had met while serving in a training capacity during World War I using methods developed by Charles Allen. Charles Allen's training methodology, developed prior to World War I for shipbuilding, would become the key to the methods developed by the Four Horsemen during their TWI Service.

From Allen's four-step training method the "J" programs would evolve and have a major impact on manufacturing in the United States during the war. The "J" programs were:

- Job Instruction
- Job Methods
- Job Relations
- Program Development

These programs were incorporated into industry by a large network of trainers set-up throughout the country by the TWI Service. They focused on the interface between supervisors and employees and proved invaluable to the United States' industrial support of the war effort.

After the defeat of Japan the occupational forces realized that in order for Japan to rise from the destruction they had received as a result of the war and to prevent chaos in the defeated country, Japan needed support in rebuilding their industrial infrastructure. The programs developed by the TWI Service were just what were needed to help the new Japanese management accomplish this goal.

A former TWI trainer and his group were contracted to come to Japan and begin the training process. They used the multiplier effect (training trainers who would be the core to train more trainers) to get the program started. Several Japanese agencies picked-up the training and promoted it at a national level. The massive training of the TWI's programs over the following decades in all facets of Japanese industry pushed the principles taught to become an integral part of what is known today as *Japanese Management*. A major key of these methods is *kaizen*, which has its source from the TWI and Charles Allen.

A review of some basic philosophies of Japanese management and kaizen proves that they are actually an evolution of a training technique developed nearly ninety years earlier in the United States. The techniques have evolved through the TWI programs of WWII and their infiltration into Japanese industry by the Allied occupational forces. They continued to evolve in post-war-Japan through today to become some of the most successful management techniques in use today in industry. The table below compares the basic four-steps of this training through this century.

Steps	Charles Allen	TWI			Kaizen
		Job Instruction	Job Methods	Job Relations	
1	Preparation	Prepare	Breakdown	Get the Facts	Observe and Time Current Process
2	Presentation	Present	Question	Weigh and Decide	Analyze Current Process
3	Application	Try Out	Develop	Take Action	Implement and Test New Process
4	Testing	Follow Up	Apply	Check Results	Document New Standard

Table 1: Comparison of Steps

SOURCE: Created by the author.

The ironic twist of these management principles is that even though they have their roots in the United States, today American companies struggle to use them to the successful level that some of their Japanese competitors do.

What Was TWI and Why Was It Formed

What was the Training Within Industry Service, TWI? What does it have to do with modern manufacturing techniques? The answer is everything. For those who have heard of lean manufacturing, Japanese management methods, and kaizen, TWI may well be the ground zero of these modern manufacturing philosophies that have developed into the most promising methods in industry today.

The TWI Service was started and developed to support industry for the United States war effort during World War II. It was established in August of 1940 by the National Defense Advisory Commission and eventually was moved under the Federal Security Agency to function as a part of the new War Manpower Commission on April 18, 1942.[1] It would remain under the War Manpower Commission throughout the rest of its existence, which ceased operation in September of 1945.

TWI was one of the first emergency services to be organized after the Fall of France on June 20, 1940[2]. As the war escalated, the Allied Forces (even prior to the United States' entry into the war) needed significant war supplies. This need greatly increased the production levels in all types of industry. The United States government realized this situation and began steps to help cover the demand of war products. Many companies were receiving increasing orders for existing and new products, which exceeded their ability to respond. It also became apparent that if the United States would enter the war, the situation would become even more critical. The TWI service was started to increase production in order to meet the serious demand that has risen upon industry. It focused on war contractors and other necessary war supply manufacturers, which continued to grow in numbers as companies transitioned to war production.

TWI established a nation-wide network of industrial professionals to teach valuable techniques to the manufacturers of war products. The network would be made up of a volunteer staff of people, some full-time and some part-time, from private industry on

[1] Labor Division, War Production Board, Training Within Industry Service, January 1943, *The Training Within Industry Program, Bulletin No. 1* (Washington D.C.: U.S. Government Printing Office), p. 3.
[2] War Production Board, Bureau of Training, Training Within Industry Service, September 1945, *The Training Within Industry Report: 1940-1945*, (Washington D.C.: U.S. Government Printing Office), p. 3.

loan from their companies. *The real job had to be done by industry, within industry*.[3] This emphasis was critical to create a legitimate organization that would be accepted by manufacturers. Also, for the same reason, TWI was never forced into any plant, but served only by invitation and acceptance of the plant's own management.

The Four Horsemen

The Four Horsemen, as they would become known for their leadership and service, were Channing Rice Dooley, Director of the TWI Service; Walter Dietz, Associate Director; Mike Kane, Assistant Director; and William Conover, Assistant Director. Dooley and Dietz were both graduates of Purdue University and had extensive industrial experience as well as previous government service in training issues during World War I. They both generously accepted the assignment to be on loan from their companies to coordinate and develop the TWI program. During their WWI assignment they had worked together and were both familiar with Charles Allen's four-step method of training. (As will be explained later, this method of training became the backbone of the TWI's programs.) Kane had been involved with industrial training most of his career and had worked directly with Charles Allen during the training of shipyard employees during WWI. He had known Dooley and Dietz from the experience with WWI. Conover had also been involved with industrial relations and training during his professional career.

The Four Horsemen were the leadership and drive of the TWI Service and it was their vision and experience that would help the TWI programs become a major success. Although it was the combined contribution of a huge number of people from industry to develop and deploy the objectives of the TWI Service, the Four Horsemen understood the magnitude of the task and what would be needed from industry and the government to evolve and guide the process.

The Results of TWI

The effectiveness of the TWI Service was very dramatic during the course of the war. *The Training Within Industry Report: 1940-1945* gives many details of the results of the programs and how TWI tracked the impact of their service throughout its existence. Given below is the tabulation of results collected by TWI at seven different intervals during its service.

	Percentage of Plants Reporting Results of 25 Percent and Over						
	May 1943	Sept. 1943	Feb. 1944	Nov. 1944	April 1945	July 1945	Sept. 1945
Production increased	37	30	62	76	64	63	86
Training time reduced	48	69	79	92	96	95	100
Manpower saved	11	39	47	73	84	74	88
Scrap loss reduced	11	11	53	20	61	66	55
Grievances reduced	(Not reported)		55	65	96	100	100

Table 2: TWI Plant Results

SOURCE: War Production Board, Bureau of Training, Training Within Industry Service, September 1945, *The Training Within Industry Report: 1940-1945*, (Washington D.C.: U.S. Government Printing Office), page 92.

[3] Ibid., p. 6.

The number of industry people to go through the five, two-hour sessions for each training program was quite large. Even though the number of those who attended the sessions does not necessarily directly translate to results, it does give an idea of the magnitude of coverage the TWI Service achieved during its short five-year existence. Considering that all of the programs had to be developed and that the Service actually started down the consulting path during its first year, the number of people trained is quite impressive.

> *When TWI operating service ended September 30, 1945, the following certification totals appeared:*
>
> *Job Instruction……..1,005,170*
> *Job Methods……...244,773*
> *Job Relations……490,022*
> *Union Job Relations……..8,856*
> *Program Development……..1,829*
>
> *Total……1,750,650*
>
> *These people have been trained in 16,511 plants and unions, in every kind and size of war industry and essential service…*[4]

How TWI Evolved During WWII

The purpose of the TWI program was directly stated in its overview bulletin,

> *To assist war production industries to meet their manpower needs by training within industry each worker to make the fullest use of his best skill up to the maximum of his individual ability, thereby enabling production to keep pace with war demands.*[5]

This objective would guide the leaders of TWI as they continued to develop the best means to apply the service during it five-year existence. The development process was very laborious, but resulted in excellent field-tested methods and procedures.

The First Effort

The initial effort was to use the TWI network of people for consulting plants on how to solve many of their production issues. The leaders of the TWI quickly learned that this method would not be adequate to help the ever-increasing number of plants requiring assistance. Despite the fact that a large portion of TWI's initial effort was promoting their services, the drain on their resources steadily increased. TWI had developed bulletins, surveys, and speaking engagements in order to "sell" their program. This process was not easy because many plants had not yet felt the pressure of training issues or thought that they did not have the time available.

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[4] Ibid., p. 126.
[5] Labor Division, War Production Board, Training Within Industry Service, January 1943, *The Training Within Industry Program, Bulletin No. 1* (Washington D.C.: U.S. Government Printing Office), p. 3.

Despite the need to sell TWI services, the strains of spreading themselves too thin continued. As the TWI leaders soon discovered, problems developed because the TWI personnel were needed as consultants and manufacturing plants were continually asking for TWI assistance with their various in-house problems. As a result, these two issues quickly overloaded the limited resources of TWI's network. Trying to tackle problems in the role of a consultant consumed a large amount of time, which was not possible if TWI members were to help the war supply industry as a whole. The in-house problems companies desired help with included machinery, material, and manpower – from labor disputes to safety problems. Beyond this, the number of defense plants continued to mushroom. Although this period during TWI service grew to be chaotic, it gave them a great lesson about what TWI should focus on to truly help industry in the war effort.

The Second Effort

The initial chaotic period of trying to organize the TWI Service redirected it toward a new plan and focus. A paragraph out of Walter Dietz's book explains what they did.

> *The district heads met in Washington where experiences were exchanged and ideas discussed. It was decided to make a major shift in the whole approach to the task and some of the original plans, such as giving contractors a consulting service on a broad range of in-plant training problems, were abandoned. Instead, the needs of the supervisors were to be the area of concentration because the serious shortage of experienced men had forced numerous plants to appoint many who were not qualified to do the job.*[6]

The new objective gave TWI the direction it would need to be successful throughout the rest of its tenure. The focus on supervisors and their interface with employees would be the critical factor needed to support the war effort. This factor is also one of the key foundations from which Japanese management methods evolved. This correlation will be illustrated below.

TWI leadership realized that the methods developed would need to be taught successfully by a wide range of trainers with differing amounts of experience and skill in a large variety of industries. In addition, this information would be delivered to an enormous number of plant supervisors possessing various levels of knowledge and experience. It was quite a daunting task and the training methods would have to be absolutely bulletproof. This issue is where Charles Allen's four-step method would play a significant role.

The Origin Of The TWI Methodology

What would be the cornerstone of TWI Service's training program was developed from methodology introduced by Dooley, Dietz, and Kane. All three gentlemen had been involved in training assignments during World War I. They used this experience to develop the TWI training programs used during World War II.

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[6] Walter Dietz with Betty W. Bevens, 1970, *Learn by Doing: The Story of Training Within Industry* (Summit, NJ: Walter Dietz), p. 13.

Charles R. Allen

During World War I, the Emergency Fleet Corporation of the United States Shipping Board implemented an urgent training program to support the training of shipyard workers due to a ten-fold increase in demand of the number of workers required. Due to this demand, only non-experienced workers were available and they needed to be trained.

Charles Allen had been a vocational instructor who had developed and presented his views on industrial training prior to WWI and later in his book published in 1919. Therefore, Allen was asked to head the training program set-up by the Emergency Fleet Corporation to address the vast training need of the shipyard workers. Allen used his four-step method, as described below, to train the shipyard workers:

> *…each complete teaching lesson calls for four steps, or teaching operations known as step 1, Preparation, step 2, Presentation, step 3, Application and step 4, Testing (or Inspection). These steps, are always carried out in the order given – The purpose of step 1 is to get the learner ready to be instructed, of step 2 to instruct him, of step 3 to check up errors, and of step 4 to give a final inspection of the instruction job.*[7]

Charles Allen's methods and philosophies also describe how to choose the best trainers, what an industrial trainer is, what he needs to know and do, and details the essence of what is and is not effective instruction. These and many other of Allen's lessons are completely interwoven in the methods and practices of the TWI program. In fact, within the first few pages of his book, Allen states its purpose:

> *This book is intended, therefore, to serve two purposes – to serve as a handbook to instructors in industrial plants, and also to serve as "instruction notes" in instructor training courses.*[8]

Allen's four-step method was the basis for all of the training programs developed and dispersed by the TWI during WWII. It was a known and proven method that had been around for thirty years. Barring a few dated phrases, the methods presented in Allen's book are just as valid and applicable today as they were in the early part of the century (WWI) as well as the middle of the century (WWII).

The Importance of Training

Allen recognized and stressed the importance of proper training in industry. He discussed how improperly trained employees create excess cost and that the cheapest method to use only well-trained people from the start.

> *…three factors in efficient production…The instructor, because it is through effective instruction that we can secure efficiency in training. The man, because when properly trained he does the best work. The job, because production efficiency comes from well instructed men doing good jobs.*[9]

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[7] Charles R. Allen, 1919, *The Instructor The Man and The Job*, J.B. (Lippincott Company; Philadelphia and London), p. 129.
[8] Ibid., p. iv.
[9] Ibid., p. 3.

To achieve the best training four principles must be applied; standards must be set, good instruction must be established, continued training must be maintained, and training must not end too soon. These principles must become an integral part of a company's process of business. These items seem to be common sense, but how many companies have this type of program in place and have mastered it even if they do?

Allen devotes much of the book to not only his four-step method of training, but to methods of instruction and effective conditions of instruction. He illustrates much of his work with shop examples and emphasizes the importance of getting the "interest" of the learner, or making the learner want to learn. He also covers in great detail the importance of selecting the correct people to be trainers, how the trainer should and should not instruct, and how the trainer should develop, organize, and deploy the training. Even though Allen's training methods are straightforward and seem like common sense, they are not very common in today's manufacturing companies.

The Four-Step Process

Charles Allen's 4-Step process was the basis for TWI's training program. The first step, preparation, focuses on, creating in the learner's mind, a connection between their past experience and the lesson to be taught. Although the learner may have no industrial experience, a good instructor will find an analogy or story, which will lead the learner to relate the present teaching objective to something he knows. Allen emphasizes that even when teaching the simplest skills or jobs, preparation is key to increasing the effectiveness of instruction. It may be stated that tying in a past experience, even though simple or only indirectly related, directs the learner's thoughts to the task at hand and establishes an "interest" for the learner. It is most likely for this reason that Allen dedicates several chapters in his book to the methods of gaining the interest of the learner.

The second step, presentation, is in Allen's words; "to lead him to 'get' the new idea which the instructor desires to 'tack on' to what he (learner) already knows". Presentation imparts a piece of knowledge to the person being trained, and each piece is only a small part of a larger lesson. An effort must be made by the instructor not to give too much information at one time. This will result in focusing on the individual point to be taught. The format of the presentation step is a well-organized process established prior to the lesson with methods chosen to allow the best direction and theme of the lesson. The presentation process developed is selected from a variety of methods, as detailed throughout the book, based on both the type of job and the characteristics and level of the learner. The effectiveness of developing the best method of presentation is completely dependent on the skill of the instructor in the following areas: selection of the proper method, organization of the lesson points, and emphasis of the most important points.

Application, the third step, establishes if the learner can "do it." Even though the learner may be in the right frame of mind (step 1) and the instructor did an excellent job of presenting the lesson (step 2), the question remains if the new knowledge can be applied. Allen stresses in step 3 that the learning contains no value unless the person can actually do it and do it correctly. The application step has two purposes:

1) *…since power to apply a thing is different from simply knowing it, he must be trained in actually applying, or putting into practice what was presented*
2) *…to check up the degree to which the learner has grasped all the points in the lesson*[10]

Another important point Allen discusses is that no matter how well the lesson has been taught, mistakes will be made and must be corrected in this step.

The final step, testing, is simply allowing the learner to do the job unaided, but viewed by the instructor. If the learner fails to do the work independently, it is a result of the instructor not implementing the proper teaching method. The instruction must be improved and repeated. He emphasizes that if each of the lesson steps had been carefully and properly developed and taught, the learner would not have failed during the test step. The fault lies completely with the instructor. Allen does explain how this situation is common and that true instruction is not an easy skill to learn. Much practice and experience are part of developing a good instructor. The person who can successfully achieve the fourth step with a learner is a rare and valuable asset. The final step is as much of a test for the instructor as it is for the learner.

Allen's 4 Step method of instruction is a series of building blocks with each one completely dependent on the previous step to be successful. Allen's explanation of his four-step method indicates that it is a method of correctly stringing together a series of *One-Point* lessons, which is common today in many companies that use lean principles or Japanese Management methods. Each individual lesson within the overall lesson must have a stand-alone point that must be understood by the learner while connected to the entire lesson. Although the explanation of the 4 steps are only four chapters of Allen's book, nearly all of the other chapters present ideas, philosophies, examples, procedures, and methods on how to understand, prepare, develop, and deliver the 4 steps successfully, or simply how to be an effective instructor.

The Courses

The connection between Charles Allen's methods and TWI's Service training program came directly from the leaders of TWI. Kane had been a member of the Emergency Fleet Corporation group under Charles Allen during the First World War. Dooley and Dietz had been on assignment for the War Department during WWI and knew Allen and Kane, as well as Allen's training methods. In fact, in *The Training Within Industry Report 1940-1945*, significant discussion is given to the work of Allen and his emphasis on stressing the difference between "teaching and telling" and "instructing and showing." The importance of teaching and instructing instead of telling and showing became the main foundation of the TWI programs, ***learning by doing***, which translates to solving problems on the job with the guidance of a properly trained instructor.[11] The *learn-by-doing* approach would become an integral part of TWI's philosophy of training.

[10] Ibid., p. 139.
[11] Training Within Industry Service, September 1945, *The Training Within Industry Report: 1940-1945*, pp. 185-190.

The Five Needs of a Supervisor

TWI continued to "sell" its service to production facilities. In order to explain to manufacturing plants why the TWI programs were beneficial, TWI developed a philosophy, which was delivered continually and became a standard part of the TWI Service. This philosophy was known as:

Every Supervisor has Five Needs:
1. Knowledge of the Work
2. Knowledge of Responsibility
3. Skill in Instructing
4. Skill in Improving Methods
5. Skill in Leading[12]

The first two needs were the responsibility of the plant or company to establish for the supervisor. This information covered equipment, products, and the skills required to manufacture them, as well as company policies, agreements, and schedules. TWI assisted companies in giving their supervisors the training to attain the last three needs. As will be discussed below, each of the three "J" programs targeted one of the three supervisor skills. These skills must be learned and practiced in order for production levels to be met and increased, especially with industry circumstances in the United States at the time.

The J-Programs

The "J" programs, as they became know as, were modeled from Allen's four-step method for training. Kane used the four-step method during one of TWI's initial program requests. A shortage of trained lens-grinders and polishers resulted in a severe lens shortage and thus, a call to the TWI Service. Kane used the four-step method to develop a 7-Step method combined with a "key points" concept to decrease the time required to train lens-grinders and polishers from years down to months. The key points concept was developed during the lens crisis. Kane discovered that, although there were a large number of operations to learn to manufacturer lenses, only a small number of the operations were difficult to master. Also, only a few steps within the vital operations were critical to understand how to successfully master the technique. As Dietz would later state, "In essence, "Key Points" means simply this: much of the supposedly difficult work in any industrial operation is relatively simple".[13] Combining his modified "Steps" with the newly developed "Key Points," Kane had not only significantly improved training for the lens crisis, but also established what would become the cornerstone of TWI's training program.

Job Instruction

Charles Allen's four-step method of industrial instruct would be used to develop the five session (two hours each) training program for Job Instruction. The first two sessions would cover the presentation and discussion of the instruction method developed and the last three sessions were used for actual practice of the method. All of the participants were to use an instruction method being taught to members of their department for actual application of the methods presented and then report back to the group during the sessions. This actual application was based on the slogan adapted by TWI, "*If the*

[12] Ibid., pp. 48-49.
[13] Dietz, p. 4.

learner hasn't learned, the teacher hasn't taught"[14]. This approach was yet another philosophy that the TWI Service borrowed from Charles Allen. Allen had repeatedly reinforced this statement, or better yet attitude, in his book and in his own instruction. TWI's mission would incorporate this approach during development and implementation of their training programs.

Job Instruction would not be officially released until it had been used, evaluated, and revised multiple times. In fact, all of the training programs would be developed in the same manner. TWI would develop the instruction method by using it in many plants and then use the feedback from the plants along with their own assessment of how effectively it accomplished its task. This approach was used to develop a sure-fire method to be successfully used in all industries, and also so that it was a method developed for industry by industry. The leaders of the TWI Service, even though they were from industry, believed that "for industry by industry" was critical for the program's acceptance and success.

Job Instruction focused on *instructing employees rather than "letting them learn*"[15]. This focus was present even prior to development of the training program and continued throughput the existence of the TWI Service. A training manual developed by the Western Electric Company during the war was published by TWI and re-emphasized this focus. It also relied on Charles Allen's four-step method and job analysis technique for developing good training methods. The manual developed, *Job Instruction: A Manual for Shop Supervisors and Instructors*, reads like a summary of Allen's book and references two of Allen's training books in its bibliography. The manual states:

> *Good teaching is helping people to learn without getting in their way of learning. Poor teaching may actually hinder their learning.*[16]

The Job Instruction training manual was developed to tackle one of the first issues realized after TWI refocused their efforts. With the steady increase in production demand combined with the decrease of experienced employees, training new personnel became a critical factor. TWI introduced Job Instruction training to help alleviate the problem. With Allen's four-step method as the backbone of the training, significant improvements were made in a large number of war production facilities.

The Job Instruction training manual referenced Job Instruction cards and their use during the training sessions. All persons attending were issued a card. The front of the card outlines the instructor or supervisor's procedure for "getting ready" to instruct. This procedure is similar to Allen's technique proposed in his book. The back of the card outlines the four-step method of *How to Instruct*. The small pocket-sized card was an important training tool. The card was to be carried by the supervisors at all times as a reminder of and reference to the methods they had been trained to use on their jobs. Pictures of the original Job Instruction cards are shown below.

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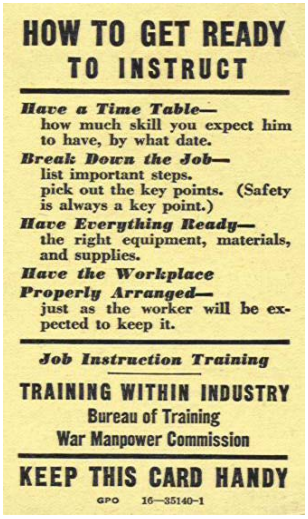
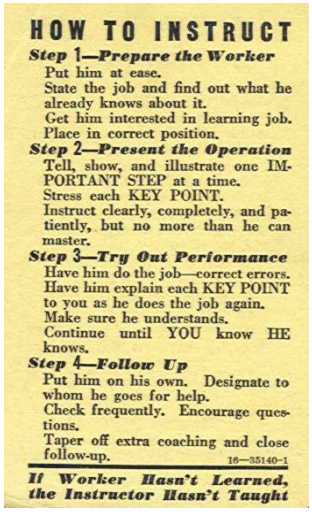
[14] Training Within Industry Service, September 1945, *The Training Within Industry Report: 1940-1945*, p. 193.

[15] Labor Division, Office of Production Management, Training Within Industry Service, August 1941, *How To Train Production Operators* (Washington D.C.: U.S. Government Printing Office), p. 1.

[16] Labor Division, War Production Board, Training Within Industry Service, date not given, *Job Instruction: A Manual for Shop Supervisors and Instructors* (Washington D.C.: U.S. Government Printing Office), p. 1.



Front of the Job Instruction Card



Back of the Job Instruction Card

Figure 3: TWI Job Instruction Card

SOURCE: War Production Board, Bureau of Training, Training Within Industry Service, 1944, *Job Instruction: Sessions Outline and Reference Material* (Washington D.C.: U.S. Government Printing Office), Inside back cover.

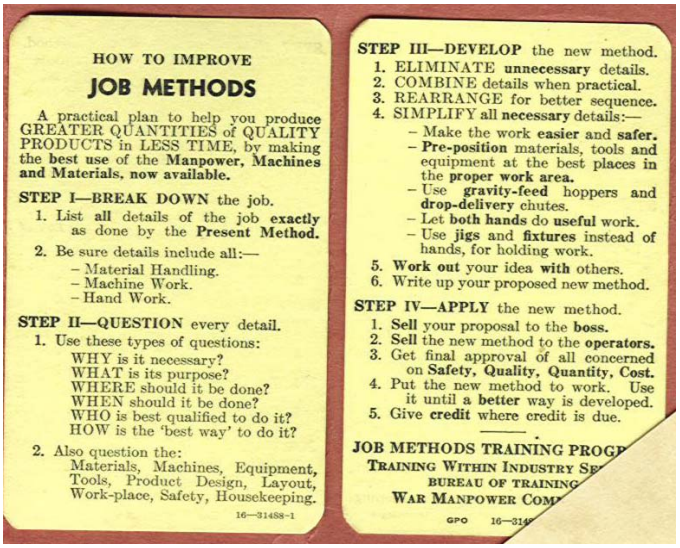
Job Methods

The objective of Job Methods training was to give supervisors a technique to achieve obvious improvements in the work area using a practical approach instead of a technical approach. Use of this philosophy provides a universal procedure that would be successful in all types of war production plants.

> *…the objective of helping the supervisors to produce greater quantities of quality products in less time, by making the best use of the manpower, machines, and material now available.*[17]

The four-step method was again used to develop the training procedure. Within the method, a procedure for breaking down jobs was critical for developing a new and improved way to do the job. A simple demonstration of assembling a radio shield was used during the training session to illustrate how to breakdown the "present" method and implement a new way for the "proposed" or improved method. The aim of the Job Methods program was to prevent supervisors from presenting ideas that were incomplete or flawed. By following the four-step Job Methods procedure, the supervisors would discover improvements during this process and create a feasible solution before presenting it to management. An outline of the procedure, like Job Instruction, was printed and given to the trainees on a small pocketsize card for continued reference. An illustration of the Job Methods card is shown below. A similarity to the method used for implementing KAIZEN can be seen in the steps detailed on the card. The reason for this will be discussed later. Job Methods proved to be another very successful program for the TWI Service.

[17] Training Within Industry Service, September 1945, *The Training Within Industry Report: 1940-1945*, p. 230.



HOW TO IMPROVE

JOB METHODS

A practical plan to help you produce GREATER QUANTITIES of QUALITY PRODUCTS in LESS TIME, by making the **best use** of the **Manpower, Machines and Materials, now available.**

STEP I—BREAK DOWN the job.

1. List **all** details of the job **exactly** as done by the **Present Method.**
2. Be sure details include all:—
   - Material Handling.
   - Machine Work.
   - Hand Work.

STEP II—QUESTION every detail.

1. Use these types of questions:
   WHY is it necessary?
   WHAT is its purpose?
   WHERE should it be done?
   WHEN should it be done?
   WHO is best qualified to do it?
   HOW is the 'best way' to do it?
2. Also question the:
   Materials, Machines, Equipment, Tools, Product Design, Layout, Work-place, Safety, Housekeeping.

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STEP III—DEVELOP the new method.

1. ELIMINATE **unnecessary** details.
2. COMBINE details when practical.
3. REARRANGE for better sequence.
4. SIMPLIFY all **necessary** details:—
   - Make the work **easier** and **safer.**
   - **Pre-position** materials, tools and equipment at the best places in the **proper work area.**
   - Use **gravity-feed** hoppers and **drop-delivery** chutes.
   - Let **both hands** do **useful** work.
   - Use **jigs** and **fixtures** instead of hands, for holding work.
5. **Work out** your idea **with** others.
6. Write up your proposed new method.

STEP IV—APPLY the new method.

1. **Sell** your proposal to the **boss.**
2. **Sell** the new method to the **operators.**
3. Get final approval of all concerned on **Safety, Quality, Quantity, Cost.**
4. Put the new method to work. Use it until a **better** way is developed.
5. Give **credit** where credit is due.

JOB METHODS TRAINING PROGR
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Front and Back of the Job Methods Card

Figure 4: TWI Job Methods Card

SOURCE: War Production Board, Bureau of Training, Training Within Industry Service, 1943, *Job Methods: Sessions Outline and Reference Material* (Washington D.C.: U.S. Government Printing Office), Inside back cover.

Job Relations

The Job Relations program was implemented mainly due to need:

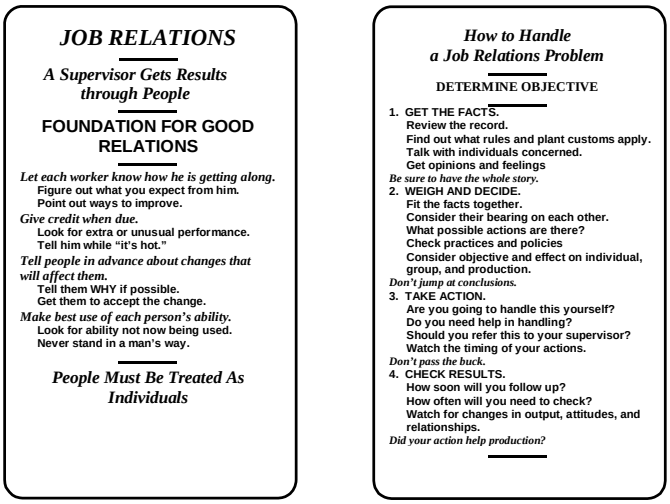
> *…that supervisors needed a great deal of help in human relations – the art of handling men.*[18]

Although the need was that of human relations between supervisors and their subordinates, it was titled with the term "job" in order to relate the program to the job, as were all of the "J" programs. With this emphasis in mind, a theme of *poor relationships causes poor results* in production and *good relations lead to good results* on the job would be the underlying objective of the Job Relations procedures developed.[19] Much of the program's emphasis was placed on teaching the importance of understanding and resolving small issues before they became large, widespread issues. During development of Job Relations training, some universal and fundamental elements were discovered. These elements became the foundation of the Job Relations program with the most vital skill for any supervisor to achieve being: *People Must be treated as individuals*[20].

As with the other two "J" programs, the four-step method was used to develop the Job Relations procedures, thus securing the underlying principles. The training sessions consisted of explaining the principles using everyday case studies involving a fictitious supervisor and his employee. Each of the four steps would be presented in a case study showing and how the supervisor handled the situation. This method was used to present

[18] Dietz, p. 19.
[19] Bird McCord, "Job Instruction," Robert L. Craig (ed.), 1976, *The Training and Development Handbook – A Guide to Human Resource Development*, 2nd ed. (New York: McGraw-Hill), p. 32-17.
[20] Training Within Industry Service, September 1945, *The Training Within Industry Report: 1940-1945*, p. 40.

the lesson to the group. Each attendee was then required to use the process in their area of responsibility and report the results back to the class. Again, a Job Relations card was made and given to each training attendee for reference. The outline for the Job Relations process is listed on the Job Relations card illustrated below.



JOB RELATIONS

A Supervisor Gets Results through People

FOUNDATION FOR GOOD RELATIONS

Let each worker know how he is getting along.
Figure out what you expect from him.
Point out ways to improve.
Give credit when due.
Look for extra or unusual performance.
Tell him while "it's hot."
Tell people in advance about changes that will affect them.
Tell them WHY if possible.
Get them to accept the change.
Make best use of each person's ability.
Look for ability not now being used.
Never stand in a man's way.

People Must Be Treated As Individuals

How to Handle a Job Relations Problem

DETERMINE OBJECTIVE

1. **GET THE FACTS.**
   Review the record.
   Find out what rules and plant customs apply.
   Talk with individuals concerned.
   Get opinions and feelings

Be sure to have the whole story.

2. **WEIGH AND DECIDE.**
   Fit the facts together.
   Consider their bearing on each other.
   What possible actions are there?
   Check practices and policies
   Consider objective and effect on individual, group, and production.

Don't jump at conclusions.

3. **TAKE ACTION.**
   Are you going to handle this yourself?
   Do you need help in handling?
   Should you refer this to your supervisor?
   Watch the timing of your actions.

Don't pass the buck.

4. **CHECK RESULTS.**
   How soon will you follow up?
   How often will you need to check?
   Watch for changes in output, attitudes, and relationships.

Did your action help production?

Front and Back of the Job Relations Card

Figure 5: TWI Job Relations Card

SOURCE: Adapted from Bird McCord, "Job Instruction," Robert L. Craig (ed.), 1976, *The Training and Development Handbook – A Guide to Human Resource Development*, 2nd ed. (New York: McGraw-Hill), p. 32-22.

Union Job Relations

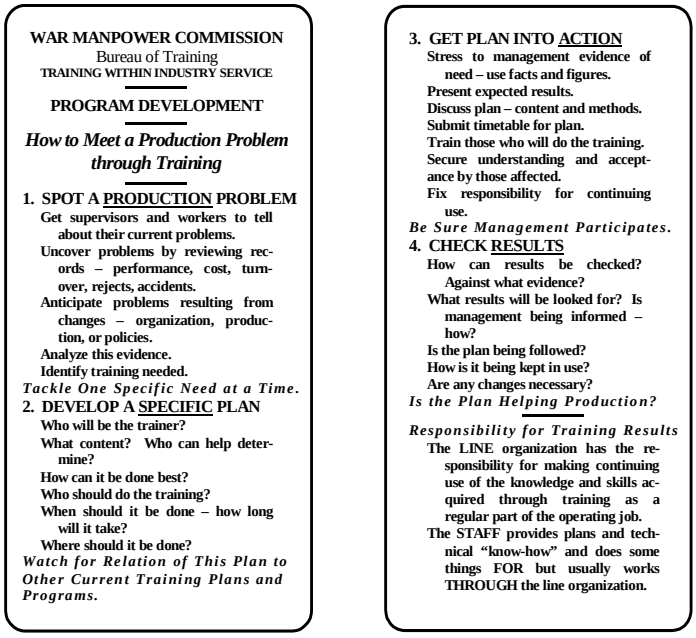
In February of 1945, the TWI Service released a Union Job Relations training manual. Development and issue of this manual resulted from many plants with unions using marked-up copies of the Job Relations manual in training of their union stewards. The Union Job Relations manual was a modified version of the Job Relation manual with the focus on union stewards instead of supervisors. It also used union problems in the four case studies to be taught.[21] The basic format was the same as the Job Relations manual. Union leadership throughout the country was very supportive of the "J" programs and found them helpful to their membership.

Program Development

Program Development was organized as a means to show plants how to set-up and administer training within their own facility using their own people. As was now standard for TWI, it utilized the four-step method and Key Points to present procedures for plant personnel to solve their company's own production problems through a training program using the "J" programs as a base. Program Development was developed using input from many experts within industry to maintain TWI's premise of "for industry by industry." A series of conferences was used to gather information, put together an outline, and develop the procedure into an accepted and usable form. Several iterations of Program Development resulted during its evolution including different names for the

[21] Ibid., pp. 220-221.

program and changing outlines. Upon its final release, a Program Development card was available and listed the four-step method as it appears in the illustration below.



WAR MANPOWER COMMISSION
Bureau of Training
TRAINING WITHIN INDUSTRY SERVICE

PROGRAM DEVELOPMENT

How to Meet a Production Problem through Training

1. SPOT A PRODUCTION PROBLEM
- Get supervisors and workers to tell about their current problems.
- Uncover problems by reviewing records – performance, cost, turnover, rejects, accidents.
- Anticipate problems resulting from changes – organization, production, or policies.
- Analyze this evidence.
- Identify training needed.

Tackle One Specific Need at a Time.

2. DEVELOP A SPECIFIC PLAN
- Who will be the trainer?
- What content? Who can help determine?
- How can it be done best?
- Who should do the training?
- When should it be done – how long will it take?
- Where should it be done?

Watch for Relation of This Plan to Other Current Training Plans and Programs.

3. GET PLAN INTO ACTION
- Stress to management evidence of need – use facts and figures.
- Present expected results.
- Discuss plan – content and methods.
- Submit timetable for plan.
- Train those who will do the training.
- Secure understanding and acceptance by those affected.
- Fix responsibility for continuing use.

Be Sure Management Participates.

4. CHECK RESULTS
- How can results be checked? Against what evidence?
- What results will be looked for? Is management being informed – how?
- Is the plan being followed?
- How is it being kept in use?
- Are any changes necessary?

Is the Plan Helping Production?

Responsibility for Training Results
- The LINE organization has the responsibility for making continuing use of the knowledge and skills acquired through training as a regular part of the operating job.
- The STAFF provides plans and technical "know-how" and does some things FOR but usually works THROUGH the line organization.

Front and Back of the Program Development Card

Figure 6: TWI Program Development Card

SOURCE: Adapted from Walter Dietz with Betty W. Bevens, 1970, *Learn by Doing: The Story of Training Within Industry* (Summit, NJ: Walter Dietz), p. 26.

The introduction of Program Development followed a familiar path for those plants that had already received the three supervisory programs.

> *The P.D. Institute Conductor followed standard TWI practice and described a production problem, then demonstrated how a training director solved it through use of a four-step method.*[22]

Program Development would be the last service that TWI would develop and deploy. By the time the last revision of it had been put into use, the end of the war was in sight and this meant the end of TWI was also on the horizon.

The Multiplier Principle

One critical technique used by the TWI Service was key to disperse the training programs on a broad scale throughout all of the country's war production facilities. It was known as the "Multiplier Principle." The multiplier principle was simple in concept, but powerful in its application. Simply put, it stated:

> *Develop a standard method, then train the people who will train other people who will train repeated groups of people to use the method.*[23]

[22] Ibid., p. 46.
[23] Ibid., p. 6.

The use of the multiplier principle allowed TWI to certify over 1.7 million supervisors and trainers throughout the United States in its brief five-year existence.

Coupled with the multiplier principle was TWI's requirement for strict adherence to follow the training programs exactly as intended. Trainers were expected to follow the manuals exactly or they would lose their license. The manuals were designed to be read from up to five feet away so that trainers could easily reference and read from them during training sessions. Each manual had reference sections explaining detailed information, font changes and symbols to denote exactly what trainers should do, emphasize, and even write on the blackboards. The Job Instruction manual had the phrase, WORK FROM THIS OUTLINE – DON'T TRUST TO MEMORY, on every page as a reminder to strictly follow the format of the booklet. Each of the three "J" program manuals had a letter to the War Production Trainers from Dooley, which contained a similar statement:

> *To assure a uniformly high standard, you should ALWAYS work from this outline. Never deviate from it. Don't trust to your memory, regardless of how many times you may present the plan. It is not difficult and if you follow instructions you can't fail.*[24]

All of these methods, along with the multiplier principle, allowed TWI to present a very standardized curriculum to a large number of plants using many individual trainers with a wide range of experience and ability. This technique was their method of maintaining quality control of their service. TWI felt that once they had developed the Job Instruction training program, as well as the other programs, that trainers must follow the sessions exactly as intended for success to occur.

The Kaizen Technique

The most interesting aspect of what TWI accomplished, aside from the huge success industry in the United States had during its war production effort, is KAIZEN. Kaizen has become one of the most recognized and emulated techniques of Japanese management methods or of the Toyota Production System, TPS. Although kaizen is just one of the many tools and/or philosophies of lean manufacturing, its origin can be traced back to the early part of the Twentieth century. In essence, Charles Allen's four-steps may be the grandfather of kaizen.

Job Methods – The Original Kaizen

In review, the objective of Job Methods was to give supervisors a method for improving production using a practical approach instead of a technical approach. TWI desired and succeeded in giving supervisors a simple yet effective method for making improvements in their work area on a continual basis. The purpose of the pocket cards was to keep this idea along with the procedures with the supervisor at all times. The term *kaizen* is usually translated as *continuous improvement for the better* or simply *continuous improvement*. A point that TWI stressed about Job Methods could literally be a definition for kaizen today.

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[24] War Production Board, Bureau of Training, Training Within Industry Service, 1943, *Job Methods: Sessions Outline and Reference Material* (Washington D.C.: U.S. Government Printing Office), p. 1.

> *Management must be shown that Job Methods was not an attempt to make professional engineers out of their supervisors. Job Methods will help supervisors to make many small improvements on the job they are closest to. TWI needed to stress this point to management, and trainers needed to steer supervisors toward the improvements that were closest to them, those which could be made without wholesale re-design of machines or tools or department layouts.*[25]

This statement is not only an important account about the purpose of Job Methods during WWII, but also is what kaizen is targeting in industry today. Masaaki Imai who has written about Japanese management methods and worked to bring these methods to the West states that, "*KAIZEN is the basic philosophical underpinning for the best in Japanese management*"[26]. Research and writing by Alan Robinson of the University of Massachusetts also confirmed that Job Methods is the pre-cursor to kaizen in Japanese management methods. In referencing the Job Methods training, Robinson states:

> *The aim of this program was to teach supervisors the importance and techniques of continuous improvement.*[27]

More detail of how the TWI programs disseminated into the Japanese industry will be explained in the next section. As will be seen, it is evident that Job Methods is the foundation of today's kaizen methods.

The Shingijitsu and the Kaizen Workshop

Masaaki Imai's book, *Gemba Kaizen*, and Jeff Liker's book, *Becoming Lean*, made reference to Training Within Industry material. Research of these documents led to *The Training Within Industry Report: 1940-1945*. As detailed previously, the report defined the program, how it developed, what it developed, and those involved throughout its five-year existence. It also references the work of Charles Allen several times throughout the report, thus acknowledging his influence on the TWI leadership. The most significant correlation between kaizen and the TWI programs was the outline for the Job Methods four-steps, which read like the kaizen training materials offered by the Shingijitsu consulting group in their *5 Days and 1 Night* seminar from the early 90's.

For those not familiar with the Shingijitsu Consulting Group, they are a Japanese consulting group specializing in helping companies implement lean manufacturing techniques. They were introduced to the West by Masaaki Imai in the late 1980's and continue their consulting service today. Several pupils of Taiichi Ohno from Toyota and its group companies founded the Shingijitsu group. Their specialty has been kaizen workshops, which have grown throughout North American and European industry since their inception.

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[25] Ibid., pp. 38-39.
[26] Masaaki Imai, 1986, *Kaizen: The Key to Japan's Competitive Success* (New York: Random House), p. xxxi.
[27] Alan Robinson, 1991, *Continuous Improvement in Operations: A Systematic Approach to Waste Reduction* (Cambridge, MA: Productivity Press), p. 18.

Listed below are phrases commonly heard and listed for anyone participating in a kaizen workshop. They highlight eliminating waste, making work task improvements, and a perpetual drive to maintain improvement activities.

- *"The answers to Why? And What? identify unnecessary details to be eliminated."*
- *"The answers to Where?, When?, and Who? Give leads for combining and rearranging."*
- *"The answers to How? Supply leads for developing 'the one best way' today by simplifying."*
- *"Work out your ideas with others"*
- *"Operators have good ideas too; often just as many as we have – sometimes more!"*
- *"Improvements are of no value unless put to work."*
- *"Put the new method to work – use it until a better way is developed"*
- *"Remember there will always be a better way. Keep searching for further improvements."*
- *"We can't afford to be 'too busy' to find time to continually search for improvements."*
- *"Improvements must be made now!"*[28]

The interesting thing about these common kaizen workshop phrases is that they are actually taken from the 1943 Job Methods training manual used by the TWI service. Therefore, it would seem that the kaizen workshop is just an extension of the former TWI training session. They both use the same methodology for implementing improvements and both emphasize the *learn-by-doing* approach. Anyone who has attended the Shingijitsu's workshop can attest to the hours, even into the night, spent on making changes out in the shop; or *learning by doing*.

As with most good and usable ideas, they are not generally new. It can be stated that kaizen is not new. In fact, kaizen is fifty years old when going back to Job Methods. Industry could be celebrating the Golden Anniversary of kaizen, but, again, that may not be true:

> *The principles of the Job Methods plan are not new. They were developed thirty years ago.*[29]

This statement is from the Job Methods training manual (1943) and is in reference to Charles Allen's development of his four-step method for instructing techniques. So now, we may well be closing in on the 90-year anniversary of the original kaizen principles. It is surprising that an industrial philosophy considered to be a modern and foreign method is actually a very old hometown practice that has just been forgotten.

[28] Training Within Industry Service, 1943, *Job Methods: Sessions Outline and Reference Material*, pp. 29 - 34.
[29] Ibid., p. 37.

TWI MAY BE LEAN'S (NOT-SO-DISTANT) GREAT UNCLE

Upon review of the information detailed above, the impact the TWI Service had on today's Japanese management methods becomes clear. How did this program disseminate into Japanese industry? What other areas in modern management may have been effected?

John Shook, who went to work for Toyota in 1983, may give the answers. He was directly involved with their transfer of management methods and production system (TPS) to North America. He sheds light into TWI's influence on one of Japan's (and the World's) most effective manufacturers.

> *I discovered them in a roundabout way in the process of "adapting" some of Toyota training materials to make them appropriate for NUMMI. When I found myself struggling with some of the concepts of a certain training program, my Japanese colleague fetched from a back-room file a yellowed, dog-eared, coffee-stained copy of the English-language original training manual, just as they had received it (minus the coffee stains I trust) some 30 years before. To my amazement, the program Toyota was going to great expense to "transfer" to NUMMI was exactly that which the Americans had taught the Japanese decades before.*[30]

TWI's Dissemination into Japanese Industry

TWI's introduction to Japan's industry began with the end of World War II.[31] During the Allied Occupation of Japan after the war ended, General Douglas MacArthur was in command. His Occupation authorities quickly realized that due to the near complete destruction of the Japanese industrial base, civil unrest was feared to be a high potential. Instead of severe punishment, as many people in the West desired, they recognized that rebuilding Japanese industry was critical. A major objective of the rebuilding was to eliminate the intense militarism that existed before and during the war and to instill a democratic attitude within industry. Some of the members of MacArthur's Occupation leadership were aware of the TWI Service and its success in the United States. They felt that the TWI programs were exactly the type of initiative that would help support the rebuilding and infuse democratic principles in Japan on a national level. In Alan Robinson's book *Corporate Creativity*, he discloses a memo from 1949, which describes the situation in Japan at the time:

> *Supervision is ordinarily a "haphazard" rule-of-thumb process, and…in-plant training is characteristically done by putting a new man under an experienced worker to pick up his skills as well as he can. Such practices are incompatible with modern industrial methods and with the achievement of high output per worker.*[32]

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[30] John Shook, "Bringing the Toyota Production System to the United States: A Personal Perspective," Jeffrey Liker (ed.), 1997, *Becoming Lean* (Portland, OR: Productivity Press), p. 69.

[31] This section is based on the research and writing of Dr. Alan Robinson of the University of Massachusetts. He has done excellent research in discovering the story behind the impact of TWI in Japanese management practices. For further details, reference his work given in the bibliography.

[32] Alan Robinson and Sam Stern, 1997, *Corporate Creativity: How Innovation and Improvement Actually Happen* (San Francisco, CA: Berrett-Koehler Publishers), p. 74.

Perhaps that most disturbing point of this statement is not related to the situation in Japan in 1949, but in fact, that it describes many of our manufacturing plants today. This method is common practice for today's supervisors in our "modern" industry!

The Occupation authorities did move forward and brought the TWI programs to Japan. The job was awarded to TWI Inc., from Cleveland, Ohio. The company was lead by Lowell Mellon who had been a TWI instructor in the United States during the war. His job was to teach the courses in Japan while implementing the Multiplier Principle. Mellon along with three instructors spent six months training thirty-five "master instructors" and set the foundation for the Multiplier Principle to take effect. Upon Mellon's departure, several government agencies continued to spread the TWI training throughout Japan's industry. By 1995, almost 100,000 TWI instructors have been certified. The official number does not reflect the actual total because many instructors received their certified training and went back to their own companies to set up internal TWI programs. As an example Toyota implemented TTWI, Toyota Training Within Industry. Takahiro Fujimoto, provides a detailed analysis of how the Toyota Production System evolved at Toyota, and noted TWI's influence into Toyota's management system:

> *As for management techniques, the Japanese automakers continued to learn the U.S. techniques related to scientific management, including training within industry (TWI)…education of first-line supervisors for quality control and continuous improvement (kaizen) started also in the 1950s, following TWI.*[33]

Another interesting fact that Robinson relates is that although the Job Methods training was translated into Japanese in 1950, it remained unmodified for nearly twenty years.[34] Many of the elder executives of Japanese companies today were the young professionals at the end of the war who became responsible for rebuilding their industry. They were trained and influenced by the TWI programs (and several others) and carried these methods with them throughout their careers. As we will see below, TWI's infiltration in Japan's industrial management continues to have an impact today.

Learn By Doing

As we have seen, the principle *learn-by-doing* was the foundation upon which TWI was built. All of the training programs were developed based on the learner using the procedure on an actual shop issue and presenting it to the group – *learning by doing*. Throughout *The Training Within Industry Report: 1940-1945*, the phrase is used and its emphasis stressed. In fact, one of the "four essentials" upon which the training programs were built was:

> *It must be built on the principle of demonstration and practice of "learning by doing," rather than on theory*.[35]

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[33] Takahiro Fujimoto, 1999, *The Evolution of a Manufacturing System at Toyota* (Oxford University Press: New York, New York), p. 40.
[34] Robinson, 1997, *Corporate Creativity: How Innovation and Improvement Actually Happen*, pp. 77 - 79.
[35] Training Within Industry Service, September 1945, *The Training Within Industry Report: 1940-1945*, p. 32.

This was the influence of Charles Allen; his four-step method was built upon creating the best possible environment to enable a perfect *learn-by-doing* situation for the learner. This feature is what the TWI Service successfully developed and promoted in the United States during the war and what the Allied Occupation brought and implemented in Japan after the war. It was such a fundamental aspect of the TWI programs that Walter Dietz's self-published book about TWI is titled, *Learn By Doing*. Its practice is still prevalent today.

The author's experience with *learn by doing* comes from his first employer after graduating from college, Aisin Seiki. Aisin is a Toyota Group company and one of Toyota's biggest suppliers. As Aisin was transplanted in North America to supply the Toyota plants, the author was a manufacturing engineer who was constantly told that he must "go do by yourself", or go out in the shop to the manufacturing line and try it by his self. This situation may not have been Charles Allen's or the TWI's best-organized manner of learning by doing, but it was a derivative of that process. The Japanese engineers who the author worked beside not only stressed "go do by yourself", but related how they had been told this same directive as "freshman" (new, fresh from school) engineers. After struggling through some CNC machine tool manuals completely in Japanese and accidentally machining a couple of fixtures, the author eventually *learned by doing*. The author also spent quite a bit of time running the assembly and machining lines as an operator. As will been seen, this is another technique used to train under the *learn-by-doing* philosophy.

Another example of the *learn-by-doing* approach is related by John Shook in his article in the book, *Becoming Lean*. John's section *Lessons in the Toyota Production System* describes his first lesson:

> *Learn by doing translates as: build some cars. After a couple of weeks of orientation, I was put to building Corollas at the Takaoka plant, which was a great experience, though I didn't appreciate every aspect at the time.*[36]

John's experience with the method was spent working on the lines in Toyota's automotive plants including stamping, body weld, paint, and final assembly. This practice is used to give engineers and managers an intimate understanding of the processes for which they will be responsible. There is no better way to understand something, than by actually doing it – *learn by doing*.

As shown above, *learn by doing*, thought to be a Japanese style of training has it roots in the TWI program brought to Japan after World War II.

Supervisor Development

TWI also introduced the use of supervisors to Japanese industry. Although supervisors have always played and continue to play a critical role in manufacturing, the growing use and role of team and group leaders can be traced to TWI's focus on the supervisor role or interface between the supervisor and operator. For those familiar with the strong support role team leaders play at Toyota, the tie into TWI training is prevalent. The team leader

[36] John Shook, "Bringing the Toyota Production System to the United States: A Personal Perspective," Jeffrey Liker (ed.), 1997, *Becoming Lean*, p. 47.

plays the role of instructor, leader, advisor, fill-in, and improvement solicitor and implementer. These functions correlate to the three "J" programs and what they taught the supervisors.

1. *Job Instruction Training (JIT) taught supervisors the importance of proper training for their workforce and how to provide this training.*
2. *Job Method Training (JMT) taught how to generate and implement ideas for continuous improvement.*
3. *Job Relations Training (JRT) taught leadership and human relations.*[37]

As both TWI and Charles Allen emphasize, the supervisor (instructor) has to have much more than knowledge of the job. They must also have the ability to develop a procedure and instruct the learner to receive, understand, and apply the function of the job. TWI also, with Job Methods and Job Relations, required supervisors to lead people and use their ideas to improve and increase production. Today, the role of the team leader or supervisor in Japanese management philosophy reflects the role the TWI Service was presenting to industry for supervisors.

Top Management Support

Anyone who has either read about or worked to implement lean manufacturing understands the absolute support management must give for lean to be successful. This requirement is a mainstay for any type of change. Another interesting aspect of the TWI program is its staunch requirement for management support in the manufacturing plants where the training took place. Upper management support for TWI training had to be forthright before any training would happen. TWI developed directives for their and the hosting company's responsibilities. The model TWI developed for this plan is illustrated below.

[37] Robinson, 1997, *Corporate Creativity: How Innovation and Improvement Actually Happen*, p. 75.

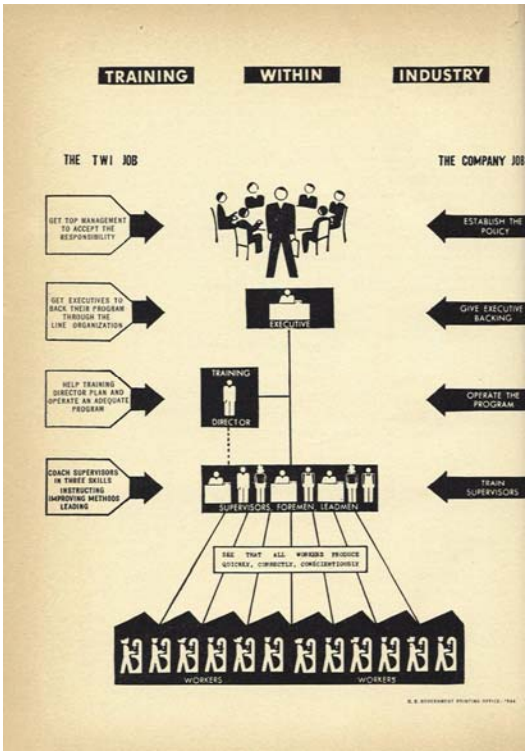

Figure 7: TWI and Host Company Responsibility Requirements

SOURCE: War Production Board, Bureau of Training, Training Within Industry Service, June 1944, *Management and Skilled Supervision* (Washington D.C.: U.S. Government Printing Office), Back cover.

This requirement was also a part of the "for industry by industry" attitude held by TWI leadership. In fact, Chapter 5 in *The Training Within Industry Report* is about the need of management support and it is titled, *Working With Management*.

> *In 1943 TWI established the policy of starting a program in a plant only after the executive group and the supervisory organization had been thoroughly informed about the TWI programs. This executive group, also, had to be thoroughly aware of its responsibility for making these programs work. It can readily be appreciated that a busy president can approve a program enthusiastically, but the plant superintendent, if ignorant of it or unsold as to its possibilities, can be a barrier.*[38]

TWI leadership had an excellent understanding of the need for top management support. They also realized that in order to get this support, they would have to "sell" the program to management. TWI developed a method to do just this. They presented training as a management tool and focused their promotion on selling results, not techniques. They understood that ultimately, most management personnel were interested in bottom line

[38] Training Within Industry Service, September 1945, *The Training Within Industry Report: 1940-1945*, p. 61.

results. This focus helped TWI achieve the initial buy-in and continued support by the large number of executives needed to make the service a success at a nation-wide level.[39]

Coaching

Another idea of the Japanese management philosophy is the use of "coaching" to lead and guide employees. This term is discussed and taught to all levels of management as a great and improved, modern method of managing people. This is considered as changing from the "old" management style of being authoritarian to the "new" style of coaching. Yet the use of coaching as a management method was repeated throughout the TWI Report. In fact, it has a section in the report dedicated to coaching and its continued use. TWI gave five points to guide plant trainers in the coaching process while instructing the "J" programs; Walter Dietz reiterates them in his book as well.

1. *Give reasons and advantages.*
2. *Get understanding of the principles.*
3. *Select a problem and work on it together.*
4. *Ask him to work another problem alone.*
5. *Give credit for good results and good effort.*[40]

The TWI report continues with a brief definition and an explanation of what it means to coach someone in a plant environment. It also ties coaching to the programs themselves and stresses how it supports the Multiplier Principle.

> *Coaching only means helping someone to do a better job of what he's trying to do.*[41]

> *The objective of a TWI program, and the objective of coaching, is not to solve a problem, but to develop ability to solve any problems when they come up.*
> *All of this means a personal working relationship – you can't coach on the phone, or in a letter, or by a lecture. You have to work with a man. His boss is the best one to work with him, out on the job. He can show him how to do a better job – not just criticize, explain why his good work succeeded so he'll do the same thing again…*[42]

Today, companies desire to promote this "new" technique to give their managers an improved manner in which to lead their people. Coaching is not new in industry as the TWI report reveals, maybe just forgotten for a time. Along with the four-steps, the four horsemen learned the value of coaching in the shop from Charles Allen.

> *The men will eventually think of the instructor as a "coach" rather than as a production foremen…Under good management…the men will not be afraid to ask questions and the questions will be to the point; there will be much discussion but there will be little argument; the men will be on the*

[39] Training Within Industry Service, September 1945, *The Training Within Industry Report: 1940-1945*. The details of TWI process are discussed fully in Chapter 5, Working With Management, pp. 60 - 75.
[40] Training Within Industry Service, September 1945, *The Training Within Industry Report: 1940-1945*, p.172.
[41] Ibid., p.173.
[42] Ibid., pp.172 - 173.

job whether they are under the eye of the instructor or whether they are not; all conditions will be business-like and "natural".[43]

Allen describes what sounds like an ideal situation between players and a coach, or what many companies are trying to achieve with their own management and workforce today. It appears that Allen and TWI were aware of and promoting what we refer to as a "team" environment within an organization.

Job Elimination Due to Kaizen

Although the TWI Service remained focused on the training it developed and its deployment at the national level, several questions were frequently asked during the Job Methods training. In fact, three questions were so frequently asked that TWI developed standard answers for them. One of the questions is also one of the most common questions raised today when kaizen is implemented in a plant. "*What should be done if employees are eliminated as a result of methods change?*"[44] TWI emphasized that this issue was to remain the responsibility of the company. Although TWI stood by this policy, they did issue a standard "suggestion" to companies in this situation.

In dealing with a specific instance during this war period, it is recommended: that no one ever be laid off as a result of a methods change but that an employee thus affected be transferred…[45]

Their suggestion is in parallel with the standard response recommended by those leading kaizen workshops today.

The 5W 1H and the 5 Whys

Job Methods discloses the source of the 5W 1H, which stands for Why, What, Where, When, Who, and How. This technique is used to breakdown a job and develop a new and improved method by questioning everything involved in an operation. Use of these questions was Step 2 of the Job Methods four-step procedure and was the transition between the old and new methods. This technique of questioning used for Job Methods was targeted to help breakdown present procedures in order to help discover better methods for doing work.

The first Job Methods sessions were frankly designed to develop a questioning attitude among supervisors with the result of getting from them ideas which already were close to the surface. The detailed questioning of the breakdown has meant that it is possible to go far below the surface and really evolve ideas which never could have appeared on the basis of suggestions.

In making a Job Methods breakdown, it has been learned that, in order to really analyze the details, it is very helpful to look first at the verb (which normally is the first word in the detail). For example, take an assembly job breakdown which has these two details; "Reach down to box on floor" and "Pick up bolt." The first step in the questioning process is

[43] Allen, 1919, p. 281.
[44] Training Within Industry Service, September 1945, *The Training Within Industry Report: 1940-1945*, p. 231.
[45] Ibid.

> *to ask "Why is it necessary?" If you ask "Why it is necessary to reach down to box?" the answer probably would be "in order to pick up the bolt." If you confine yourself to the verb, and say "Why is it necessary to reach down?" you are immediately led into considering the possibility that the box of bolts should have been up on the whole work bench.*[46]

The 5W 1H are still used today in kaizen for discovering improvements. Use of these questions has virtually remained unchanged since the TWI service included them as part of Job Methods. Although Toyota uses the 5W 1H today, they also use a modified version as a direct problem solving technique; the 5W 1H or the 5 Whys and 1 How. Most often this method is referred to as the 5 Whys.

> *When a problem occurs, if the manner of probing into the cause is insufficient, measures taken can become blurry. At Toyota, we have the so-called five W's and one H. The five W's are not the conventional "who, when, where, what and why," but every word is replaced by a "why," and we say "how?" In this way, we delve into the true cause that is hidden behind the various causes. It is essential that we come face to face with the true cause.*[47]

For anyone who has been trained to use the 5 Whys, the sequence listed above from the 1945 Job Methods procedure is the basic process. It also makes sense that the 5 Whys are used to solve problems or supplement kaizen. Kaizen is, in a sense, the resolving of work problems – or improvements.

Waste Elimination

As an extension of the 5 Whys, Job Methods is about job improvement or in today's terms, waste elimination. Further discussion is given about the job breakdown technique in the TWI report and how it supports the four-step method of Job Methods. As we recall, the outline of the four-step method very closely resembles the methodology used in kaizen workshops. Listing the details of an operation, questioning all steps presently involved in a job, developing new methods (combining, rearranging, simplifying), and applying the new methods are all part of both Job Methods and kaizen workshops. Basically it is setting the original standard and then asking why, then improving it – the essence of kaizen. The focus of both of these methods, kaizen and Job Methods, is about waste elimination (removing unnecessary or non-value added activity from the current process).

> *This improvement was not accomplished through speed-up, but through elimination of unnecessary details.*[48]

> *Use it until a **better** way is developed.*[49]

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[46] Training Within Industry Service, September 1945, *The Training Within Industry Report: 1940-1945*, p. 234.
[47] Japan Management Association, 1986, *Kanban: Just-In-Time at Toyota* (Cambridge, MA; Productivity Press), p. 27.
[48] Training Within Industry Service, September 1945, *The Training Within Industry Report: 1940-1945*, p. 224.
[49] Ibid., p. 227.

Maybe that is why Masaaki Imai states in his 1986 book, Kaizen:

> *I would like here to propose KAIZEN as the overriding concept behind good management. It is the unifying thread running through the philosophy, the systems, and the problem-solving tools developed in Japan over the last 30 years. Its message is one of improvement and trying to do better.*[50]

The TWI Service was doing nothing more than promoting good management practices as a means to improve production.

Why U.S. Industry Lost TWI

So the questions arise; why did the United Stated, the developers, implementers, and teachers of such a simple and successful program, lose it, only to be throttled by it in manufacturing markets decades later, and have no idea what was behind the Japanese management miracle? Both of these are good questions. No simple and straightforward solution will totally answer them. But there are certain factors, which played a significant role in why it happened.

Top of the Industrial World

At the end of World War II the United States was at the top of the industrial world. Not only had it led in the victory of the war in both the Pacific and in Europe, but also the U.S. had been supplying products to America and its allies before and during the war. An incredible build-up of industrial strength had occurred. The United States due to its determination as a country, large amount of resources, and natural barriers (the Atlantic and Pacific Oceans) had become a major Superpower and with no damage to its infrastructure. In fact, the U.S. was in quite good shape with high morale and a stronger than ever industrial base. It had achieved this stature with many of the "boys" overseas fighting the war as well.

The "Boys" Return

With the end of the war, the men fighting overseas would return home and back to the plants in which they had worked prior to the war. The TWI Service was no longer in existence; it was no longer needed with the victory of the war and was shutdown. The leaders of TWI understood the situation and realized well in advance that the end was inevitable. In fact, they relate in the report how they always felt that the end of their service was just a few days away. This "feeling" lasted about five years, much longer than they had anticipated.

The adjustment of returning to civilian production was also quite a task. The men returning from the war effort had not been trained in TWI methods and the TWI's national support network no longer existed. With the United States on top of the world industrially and men untrained in TWI methods returning to fill their prior roles, the critical emphasis needed for the TWI effort was gone. Once settled in, it would be natural for the returning men to get back to their pre-war routine. This situation may be the biggest contributor to the loss of the accomplishments of the TWI Service. In fact,

[50] Imai, 1986, *Kaizen: The Key to Japan's Competitive Success*, p. xxxii.

the leadership of TWI understood this concern and in the report relates information on how things may change once the war effort is finished.

> *In looking at the simplicity of TWI programs it would seem that, since they only represent common sense, their development should have been possible without too much trouble. But it must be remembered that a lot of non-essentials had to be eliminated.*
>
> *The TWI programs have been developed under opportunities never before available – the nation's war plants have been the laboratory, the experimental shop, and the proving ground. Development work would have continued as long as TWI existed – no program is ever perfect, and no program is any good unless it meets needs. Since needs change, any program must be kept growing.*[51]

It would appear that Dooley, Dietz, Kane, and Conover could sense the pending peril for the TWI programs after the conclusion of the war, which would terminate the need. As may be recalled, a good portion of TWI's effort was spent selling the need and services to the management of companies even with the critical demand war production. The TWI leadership even suggests that perhaps as much time was spent on selling the training as was spent conducting the training. With this combination, the loss of the "need" and the untrained "boys" returning it seemed destined for TWI principles to fade from the industrial landscape, and time has proved this to be so.

Resistance to Change

One final factor should also be considered as a contributor to TWI's disappearance, the resistance to change. People's resistance to change seems to be a natural occurrence. Most individuals will work to remain in a comfort zone, even if receiving pressure to change. This opposition has been the norm in industry as well.

One technical reporter from the *American Machinist* magazine tells a story of when a friend of his was trying to show a head toolmaker a new type of tool system; he is accused of peddling some useless "newfangled" method. He was not selling anything, just trying to show what was going on in industry.[52] The interesting point of this story is that it dates from around the year 1904.

Industry has always resisted change. This is illustrated in the books, *Lean Thinking* and *Becoming Lean*. Both books have information and stories about the difficulty of introducing change into a plant. In the case of these books, it is the implementation of lean that leads to resistance by industrial people. So in a broad sense, today's difficulty implementing Japanese management methods and lean philosophies may be a repeat of the difficulty the TWI Service faced when working with companies sixty years ago to implement some of the same philosophies. Granted, Japanese management and lean philosophies are much more encompassing than the TWI programs were, but they do come from the same roots.

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[51] Training Within Industry Service, September 1945, *The Training Within Industry Report: 1940-1945*, p. 261.

[52] Fred H. Colvin, 1988 (originally published in 1947), *Sixty Years with Men and Machines* (Bradley, IL: Reprint by Linday Publications), pp. 42 - 43.

CONCLUSION

The arguments detailed above are probably not the only reasons that TWI methods and philosophies mirror Japanese management practices or lean philosophies; many things contributed to their development. But one thing is sure; TWI did play a significant role in the evolution of Japanese management practices and lean philosophies, some directly such as Job Methods, and some not so directly. In the end, most have survived in Japan because they were superior techniques used in a comprehensive manner to help companies achieve a competitive advantage. The need for change in Japan began after the war, and the need continues even today.

Although U.S. companies failed to continue using the methods developed and deployed by the Training Within Industry Service after the war, today's companies often resist change not wanting to emulate the Japanese kaizen techniques. But in fact, kaizen or Japanese management methods are not specifically Japanese or American techniques; they are the result of an evolutionary process with significant contributions from both. Based on direct intentions and unforeseen circumstances in industry, the practices advanced forward to what they are today. It may be that the ideas started with a man by the name of Charles Allen and continued with the contribution of thousands of people from both sides of the ocean and will continue to evolve as many more learn how to apply it – *learn by doing*.

Even today the question remains, "Can these techniques be successfully implemented?" Many manufacturers incorrectly assume that Japanese management methods and kaizen are effective in Japanese companies because of their unique culture, but this is not true.

> *Frustrated by their inability to replicate Toyota's performance, many visitors assume that the secret of Toyota's success must lie in its cultural roots. But that's just not the case.*[53]

We have shown that these modern manufacturing techniques are, in fact, nearly one hundred year old methods that have evolved over the years with their underlying themes unchanged. It is ironic that although U.S. industry developed the methods that form much of the basis of Japanese management and lean philosophies, the United States has struggled over the last twenty years to fully implement these philosophies in our present-day systems. Success in the future of U. S. manufacturing may depend on, *if we can do what we have already done*.

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[53] Steven Spear and H. Kent Brown, September-October 1999, "Decoding the DNA of the Toyota Production System", *Harvard Business Review*, Reprint 99509, p. 97.

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