

*Note: This article is part four of a ten part series written by Art Smalley in conjunction with the 2014 TWI Summit hosted by Lean Frontiers. Art helped facilitate a meeting of TWI thought leaders that is held each year during the Summit. Following this meeting, Smalley composed his thoughts and opinions in a series of papers aimed to support the TWI community's body of knowledge. Smalley's website can be found at [www.artoflean.com](http://www.artoflean.com). The annual TWI Summit website can be found [www.twisummit.com](http://www.twisummit.com).*

In three earlier posts I looked at different ways to improve TWI Job Instruction Training based upon observations and problems I run across on my travels. In this post I have one final and more far reaching idea with regards to improving TWI Job Instruction. I refer to this as the TWI JI 2.0 problem and its relevance today for most organizations. This last TWI JI idea is frankly not so simple and let me try to explain. As great as TWI Job Instruction is it has some inherent limits. This will take some explaining and the concept is easily prone to misunderstanding. Bear with me until the end if you will please.

Historically TWI Job Instruction was created to help train people safely, correctly, and contentiously in production. I throw in "quickly" as well since in reality it was helping manufacturing companies in the U.S. develop critical skills more rapidly when the country experienced a critical shortage. As explained in [Part 1](#) of this series lens grinding and shipyard welding were two such famous examples. Both of these are of course production work examples and finding analogous problems today is very easy. This area is where TWI Job Instruction tends to be applied in operational settings for manufacturing, health care, service, and other settings even today.

Of course there are many more ways to think about and creatively use TWI JI training - that is not my contention at all. In fact I have used TWI JI concepts with people in skilled trades (even trouble shooting), executives (running meetings, annual planning, etc. etc.) and even scientists (lab work and test methods, etc. etc.) in national laboratories. The applications to situations where procedural knowledge and step by step application is a "no brainer" and your only limit is initiative.

However there is a point where TWI Job Instruction runs into problems. The inherent assumption behind JI is that a repetitive pattern exists and an expert also exists to copy. TWI JI does not do as well when new work or creativity is required. One can of course argue it was not designed for that purpose and I would fully agree. However that is essentially my point. In the U.S. we have critical skills gaps and it takes a long time to develop experts in many areas of what I call "high skills" work. Sadly we have no standard way of addressing this problem in most instances. We tend to simply live with it. For one simple explanation purposes say it takes 5 to 7 years to make a good engineer in Boeing or Toyota (at least that is what they claim). How would you make a really good new hire engineer in one year (or less) instead of seven years? Suddenly just writing down a couple of patterns or a few breakdown sheets is not the entire answer it is only a part of the initial answer. Creating hundreds of Job Breakdown Sheets is not the answer either as I will attempt to show below.

For example in the case of the engineer (and I have more problematic examples below to really make you think!) we can of course create TWI JI Job Breakdown Sheets for many thing such as engineering change instructions, spare parts ordering, defect analysis reports, or other standard tasks. Those are what I call initial tasks. However how about when the engineer is tasked to make something new that has never been done before? Design a new process, design a new tool, reduce cost in the current system by 20%, radically improve performance or design new features, etc? Suddenly the limits of traditional TWI JI come into

play. There is no set answer to cut, copy and paste, etc. There might not even be something to observe yet. In these cases you can only write very high level generic Job Breakdown Sheets at the concept level (e.g. requirements, design, develop, test, manufacture, test, quality, etc. etc.). There is value to that activity however it does not get you to the details of an improved new design nor does it necessarily radically shorten the learning curve by say 90%.

Problem solving routines are a good next step example to consider. One can easily create a Job Breakdown Sheet for Problem Solving and I have done that many times. There are important steps, key points, and reasons why at the concept level for each step. However each problem in reality is often different and the devil is in the details especially on complicated problems. For example you can try to create a Job Breakdown Sheet for just for the step of root cause analysis. However no two problems are alike and the expert has to know many ways of analyzing the problem as well as the root cause. That was one of the points behind Prof. Ishikawa's 7 QC tools. There is often not just one way to do things but several. Cause and effect diagrams, 5 Why Thinking Routines, regression analysis, Design of Experiments, Principal Component Analysis, Taguchi Methods, etc. might work for analysis. You don't want to do them all however. And coming up with a countermeasure often requires new solutions. For example think of the [Space Shuttle Challenger explosion example](#). A permanent recurrence prevention countermeasure ultimately involved redesign of the solid rocket booster to avoid the previous problems with the O-rings not working properly below 50 degrees of ambient temperature. You don't just follow a Job Breakdown Sheet and arrive at a quick and easy answer in that case. A new design had to be generated in this case.

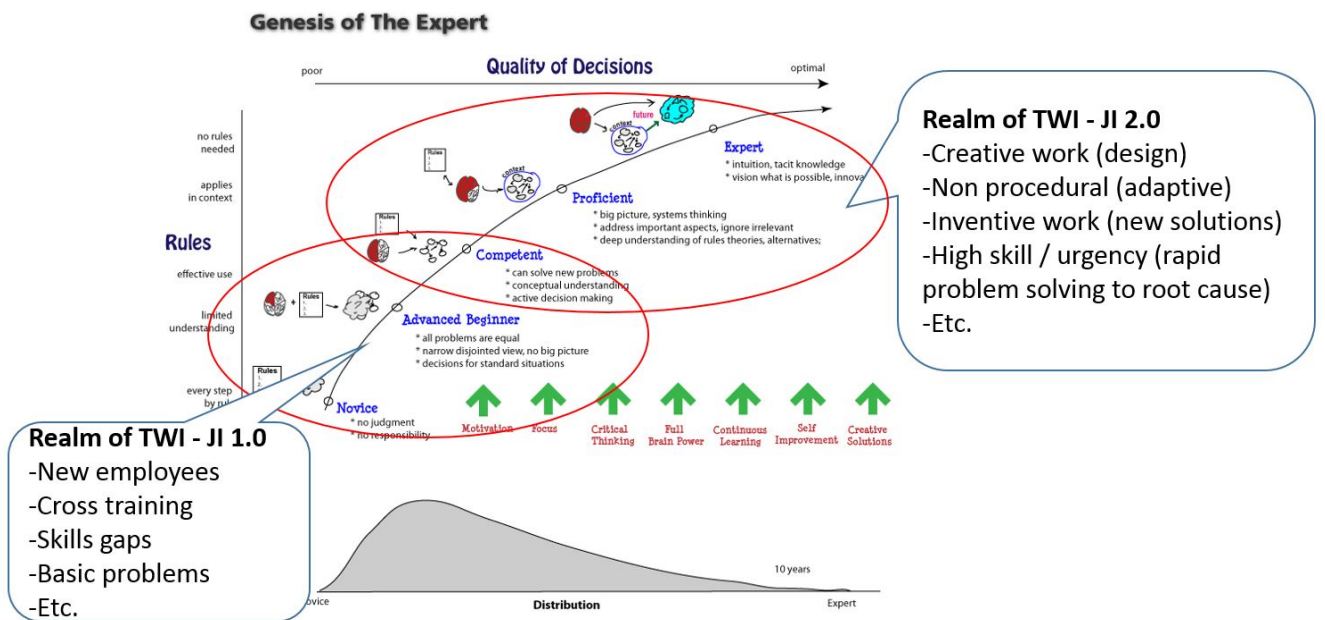
Some may argue with me (and they have on this topic) however what I view as the fundamental underlying factor here is the issue of merely copying and training to existing procedural knowledge versus creating new knowledge, products, processes, or solutions. TWI JI in its original form was not designed to handle this more complicated problem. And yet this problem is more relevant today than the lens grinding or welding problem of World War II. Here are some the strange examples I am thinking of just for stretching the mind and generating new thinking on the topic. For example how do you create an expert in chess (not just teaching the basic moves!). Remember an opponent is involved and he or she moves each type after you do. Patterns are conceptual and generic and have to constantly adapt, etc. on the fly. How do you create an expert NFL quarterback in less time (not just for the simple play call!). For example how do you teach a QB after the ball is snapped to properly and simultaneously read all of the field and make the best throw under extreme time and physical pressure? Remember again the defense disguises intent pre-snap and may blitz or do something different each time by design as their goal is to disrupt your sense of pattern and comfort level.

- Similarly how do you make an expert violin player or golfer faster?
- How do you make a great product design engineer faster?
- How do you make an expert problem solver faster?
- How do you make an expert strategy consultant faster?
- How do you make an expert doctor or researcher faster?
- How do you make a CEO faster?

Behind all of these cases there is the pop culture thinking that it just takes 10,000 hours to make an expert based upon the book *Outliers* by Malcolm Gladwell. However that book is so flawed in so many ways I could not even finish reading it. It is a pop culture wonder and yet a scientific failure of epic proportions.

(Note: If you don't believe me read all the one start reviews from extremely smart people and you will start to see what I mean). Quantity of time is no substitute for quality of input. There are many more variables in the equation. The question with regards to TWI Job Instruction should be how to make an expert from a qualified pool in say 1,000 hours instead of 10,000 hours for example. Keep in mind that a merely average person can also train 10,000 hours and it won't matter in many cases. For example anyone reading this can practice golf for 10,000 hours or basketball for that matter. You won't make it into the pro's I guarantee you no matter how much you try or practice. Again quantity is no substitute for quality and a short slow person will never be a pro in the NBA in any case.

I don't have the answer to this vexing problem. However if you ask leading executives what keeps them awake at night it is not about basic skills training for entry level positions in their company. In addition to many other things they often fear the loss of talented leadership and deep expertise in the company in certain positions. Companies are often only one deep in key leadership or expert functional areas. And it takes a long time to replace the talent if it leaves. In concept this is the same problem as shortening the lead time to learn in the lens grinder problem. However the old answer of what I call TWI JI 1.0 is not sufficient to solve the problem. It is a necessary part of the process however it alone is not sufficient...



In summary I will borrow a graphic used above summarizing the work of a couple of professors from U.C. Berkeley Stuart and Hubert Dreyfus. The graphic was entitled "The Genesis of An Expert" and it breaks down the stages a learner progresses through from a novice stage to that of an expert. For the U.S. Air Force personnel they were studying it generically it takes 10 years or so to make an expert and identifies these as the typical stages. I have no problem with the general depiction or the stages, etc. Others might quibble. However my question remains - "How do you decrease the lead time to make an expert dramatically". And by dramatically I mean by at least 50% on a consistent basis for the difficult types of work I listed above. Sadly TWI JI 1.0 best applies to the first part of the learning curve and not as well to the latter part of the curve where expertise, creativity, and break through solution space exists. Experts create new patterns whereas beginners merely follow or train to existing patterns. If anyone can crack this

problem I guarantee you will have no shortage of work and you will become a very famous and in high demand. This is a major stretch goal for improving TWI JI 2.0 for the 21st century and not merely applying TWI JI 1.0 to proven solution spaces of the past.