"I ain't gonna teach it!"

Is the Cpk merely a substitute for spec's?

After sitting in on a round table with the late Dr. W. Edwards Deming in the early 80's, one of the first steps I took to learn more about his principles and statistical methods was to attend seminars taught by Dr. Chuck Holland, Dr. Donald Wheeler and the late Dr. David Chambers. At the time, they were associated with the University of Tennessee's courses in Statistical Process Control (SPC) and Design of Experiments (DOE). Later, Chuck Holland left the university and established QualPro, a management consulting firm dedicated to helping companies drive continuous improvement. At around the same time, Wheeler and Chambers founded Statistical Process Controls, Inc., but they also collaborated with Chuck on several QualPro programs.

I engaged Chuck to teach seminars in several divisions of the company I was working for at the time. He did an outstanding job helping our managers, engineers and process improvement project teams learn and apply the methods, and he was also extremely knowledgeable about the Deming principles. After I started my own consulting practice in 1987, I was honored to be invited by Chuck to teach seminars for QualPro clients.

In addition to getting to work with a lot of companies in a variety of industries, the best part of my association with QualPro was the quarterly get-togethers Chuck hosted for his team. I got to spend long weekends with Chuck, David Chambers, Don Wheeler, Art Hammer, Frank Keery, Randy Conway and other QualPro instructors. We'd share experiences and ideas; we'd discuss better ways to help people understand and apply the statistical methods; and we'd laugh a lot – especially at the humor of David Chambers and his Texas drawl.

During one of our weekend meetings, we were talking about the recent study at Ford's automatic transmission assembly plant in Batavia, Ohio. The study clearly indicated that conformance to specification did not assure good quality. The transmissions made by Ford were found to be using 90% of the total tolerance. The assemblies supplied by Mazda – made for Ford to Ford's design and specifications – used only 27% of the total tolerance.

The Ford transmissions had higher warranty costs and repair frequencies than the Mazda assemblies. Both products were 100% conforming to specification; but the Mazda transmissions were of superior quality. It was a breakthrough in Ford's understanding and definition of quality. Bo Westerkamp, a Ford Quality Control Supervisor involved in the study, summarized their findings: "I guess the bottom line that we learned is that meeting blueprint is not good enough."[1] No longer could quality be defined as conformance to specification; we had to teach a definition of quality as *minimal variation* around the target or optimum value.

In his text, *Out of the Crisis,* Dr. Deming quoted John Betti of Ford Motor Company: "We in America have worried about specifications: meet the specifications. In contrast, the Japanese have worried about uniformity, working for less and less variation around the nominal value..."[2] The QualPro team agreed to make reference to the Batavia study in our seminars. It definitely confirmed everything Dr. Deming was teaching about the importance of reducing variation.

We then proceeded into a discussion of the process capability index *(Cpk).* Many of our clients' customers were requiring *Cpk* information about their processes, and Chuck Holland wanted to

make sure we were consistent in how we explained and taught the index. The discussion went on for some time when Dr. Chambers growled, "Well, I ain't gonna teach it!"

Can the *Cpk* be a barrier to improvement?

We asked why and David replied, "It ain't nuthin' but a substitute for spec's." We agreed that he had a point; but many of our clients' customers – especially in the automotive industry at the time – were requiring *Cpk* information. Chambers remained adamant; "I ain't gonna teach it."

He went on to explain that in too many organizations, you'll ask about current quality levels and people will report that the product is conforming to the specification. "Then they say 'good enough' – it's meeting spec." David added that the conformance-to-specification mentality has always been a barrier to improvement.

By the same token, he said, "Now someone will ask, 'What's the *Cpk*?' If you tell them the *Cpk*'s at 1.33, they'll say 'good enough'!" David repeated, "It ain't nuthin' but a substitute for spec's." He warned that misuse of the *Cpk* will also be a barrier to continuous improvement, just like the current specification model.

It's worth noting that Chambers did not even address the *Cpk* in the first edition of the text, *Understanding Statistical Process Control*, that he wrote with Don Wheeler in 1986; nor did they include approaches to calculating any capability ratios at all. Instead, they issued the warning, "This is why there is absolutely no justification for the use of capability ratios. Essentially, they are jargon that cloud the issue more than they clarify it."[3] (Wheeler later added some material about the *Cpk* – under the heading, "Capability Confusion" – in the book's second edition that was published after Chambers died.) Because of his knowledge and talents and insights, Dr. Deming once told me, "We should build a statue to David Chambers." When David passed away in 1989, Deming noted that "his loss is irreparable."[4]

In their text, Wheeler and Chambers cited an example of "continual improvement" at Tokai Rika Company, a manufacturer of lighter sockets in Japan. They presented an extensive summary of charts and data maintained by Tokai Rika from August 1980 to October 1981.[5] David and Don reported that…

1. The process output was centered on the nominal of the design specification, using only 20 percent of the tolerance.

2. During the period represented by the data, Tokai Rika produced 2,906,000 parts without a single defect.

David's prediction proves to be true.

Several months ago, I was teaching one of my seminars in a medical device manufacturing company. An engineering manager reported that they require a *Cpk* of 1.33 for "critical to quality" characteristics, "because we won't tolerate more than 64 parts per million defective from our suppliers." I asked, "If it's so critical, why don't you require a higher *Cpk*?" He replied, "Who's going to pay for that?" At the time, I think I heard David Chambers roll over in his grave.

On another occasion, I met a Vice President of Engineering at a company that makes capital equipment for the electronics industry. During our discussion, he said, "If we get to a *Cpk* of 1.33, that's good enough in our industry." I wonder if David rolled over in his grave again.

In 1987 – before the spread and popularity of so-called Six Sigma – the Mazda transmissions were centered on the nominal, using only 27 percent of the total tolerance. In other words, the first Ford Escort transmissions Mazda ever made were *Eleven* Sigma – and we are settling throughout American industry for Six Sigma. In fact, few so-called Six Sigma companies are even requiring Six Sigma quality levels. The most common *Cpk* standard I encounter for both internal operations and external suppliers is a *Cpk* of 1.33 – or merely *Four* Sigma.

Here we are in the 21st century, getting all excited about Six Sigma (though often settling for Four Sigma). More than three decades ago, a little lighter socket manufacturing company in Japan was maintaining *Fifteen* Sigma capability! A Six Sigma capability level produces only about 3.4 parts per million defective. 33 years ago, a little lighter socket manufacturer produced zero parts defective out of close to *three million.*

Sadly, David Chambers' prediction proved to be accurate. We are misusing the *Cpk* as a substitute for specifications; as a new way to define "good enough;" as a barrier to improvement. How can we overcome the malaise and mediocrity that characterize too many U.S. organizations? Perhaps we should consider going "back to the future." Back in the 1980's (and even before that) Mazda and Tokai Rika and Toyota (and even Ford) and other successful companies adopted Deming's principles. They accomplished dramatic improvements in quality, productivity and competitive position – far beyond mere four sigma quality levels.

Let's go back to the future; let's heed David Chambers' warning and study Deming's system of profound knowledge, adopt his principles and apply the powerful statistical methods he taught. Let's provide leadership to create healthy environments for work, for learning and for continuous improvement. Let's stop settling and let's start using all of our gifts to accomplish excellence.

Or, we can accept *Cpk*'s of 1.33 and settle for mediocrity. As Deming was fond of saying, "It's not necessary to change. Survival is not mandatory."

Notes

[1]"Continuous Improvement in Quality and Productivity," Film produced by Radio, TV, and Public Affairs Staff, Ford Motor Company, Dearborn, MI (1987).

[2]W.E. Deming, *Out of the Crisis,* MIT Center for Advanced Engineering Study, Cambridge, MA (1986), p. 49.

[3]D. Wheeler and D. Chambers, *Understanding Statistical Process Control,* SPC Press, Inc., Knoxville, TN (1986), p. 137.

[4]D. Wheeler and D. Chambers, *Understanding Statistical Process Control, Second Edition,* SPC Press, Inc., Knoxville, TN (1992), Front Matter.

[5]Ibid., pp. 154-177.