The Scientific Method is the Standard for Vocational Evaluation and Vocational Expert Testimony

Abstract

Ever since the United States Supreme Court decisions in the cases of *Daubert v. Merrell Dow Pharmaceuticals* (No. 113 S. Ct. 2786, 1993), *General Electric Company v. Joiner* (No. 94-9131, 1996) and *Carmichael v. Kumho Tire* (*No. 97–1709*, 1999) regarding the admissibility of expert testimony, controversy has been disparate among *Vocational Experts (VEs)* regarding what is and is not an acceptable methodology for assessment in vocational evaluation. This includes such issues as individual employability, wage earning capacity, transferability of job skills and other important vocational issues. While debate among *VEs* has had wide variance between *scientific* and *non-scientific* methods, the US Supreme Court decisions were not ambiguous: ***The Scientific Method is the Standard for Vocational Evaluation and Vocational Expert Testimony.***

Introduction

Any discussion of expert testimony begins with *Rule 702* of the *Federal Rules of Evidence (FRE).* For 70 years, the civil courts have permitted expert witnesses (including Vocational Experts) to testify under the *Frye* or "general acceptance" standard (*Frye v. U.S.,* 1923). Quite simply, the *Frye* standard stated that if expert testimony was based on methods generally accepted in the relevant professional field of knowledge, it would be admissible. In 1993, the US Supreme Court ruled in the *Daubert v. Merrell Dow Pharmaceuticals* case that the *Frye* standard was no longer to be the guideline. The Court stated that *Rule 702 of the Federal Rules of Evidence (FRE) – Testimony by Experts* – did not mention "general acceptance" as the standard. *Rule 702* simply states that:

> *If scientific, technical or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training or education may testify thereto in the form of an opinion or otherwise.*

The Court decision in *Daubert* outlined four primary considerations for admissibility of scientific expert testimony:

1. Whether a theory or technique from which evidence is drawn has been tested;
2. Whether the theory or technique has been subjected to peer review and publication;
3. Whether the theory or technique has a known potential rate of error or standards; and
4. Whether the theory or technique used has been generally accepted.

The *Daubert* decision offered guidelines on admissibility of "scientific" evidence, but only if it was both relevant and reliable. It did not address *non-scientific* disciplines, since *scientific* evidence was the subject and issue of the case. The decision also stated that the *FRE* "assigns to the trial judge the task of ensuring that an expert's testimony both rests on a reliable foundation and is relevant to the task at hand." In the case of *Kumho Tire v. Carmichael* (1999) the Supreme Court reiterated *Daubert's* general holding – setting forth the trial judge's general "gate keeping" obligation. However, the Court went further and applied the rule not only to testimony based on "scientific" knowledge, but also to testimony based on "technical" and "other specialized" knowledge.

In the case of *General Electric Company v. Joiner* (1996), the Supreme Court mandated that the same standards must apply when the trier of fact either allows or disallows an expert's testimony. This decision, commonly referred to as the "abuse of discretion" standard, reinforces *Daubert* by implying that judges be active in making determinations as to both the relevance and reliability of expert testimony.

One key term in legal parlance is "knowledge." The Court noted that "knowledge" means "more than a subjective belief or unsupported speculation" and includes "any body of known facts or any body of ideas inferred from such facts or accepted as truth on good grounds." Again, the clear intent was to insure that testimony or evidence submitted "is not only relevant but reliable."

The decision in *Kumho Tire v. Carmichael* was different from *Daubert*, in that it was a product liability case and the expert testimony was that of a technical tire expert. The expert contended that a product defect designed and manufactured by *Kumho Tire* (defendant) caused injuries. The evidentiary dispute involved the expert's specific methodology, which involved a visual inspection of the tire that was allegedly defective. *Kumho Tire* contended that the expert failed to meet the reliability requirement in *FRE 702* as set forth in *Daubert* and was granted ***summary judgment***. Following several appeals, the US Supreme Court clarified the prior decision in *Daubert v. Merrell Dow Pharmaceuticals*, with Justice Breyer stating that *FRE 702* applied to the admissibility of ***all expert evidence*** without any distinction between "scientific" knowledge and "technical" or "other specialized" knowledge. Justice Breyer stated that the *Daubert* case addressed *scientific* knowledge since that was what was at issue in that case, but that the Court did not intend to limit the evidentiary rationale of *FRE 702* (Latham, 1999).

Literature Review

Literature supporting applied scientific methods in vocational evaluation long predated any rulings of the US Supreme Court, with excellent examples being Super & Crites (1949, 1962); Thorndike & Hagen (1969); the US Department of Labor (1979) and Bolton (1976, 1987). Without becoming too didactic, it is imperative that a competent VE be knowledgeable from an historical methodological standpoint, as well as being versed on current issues in the profession. Such an investigation will demonstrate that the current debate on scientific method has a long and rich history in vocational evaluation literature.

Vocational Evaluation as a profession falls within the purview of *Daubert* and subsequent rulings in that the profession includes all three of the areas specified – ***scientific*, *technical* and *specialized knowledge***. Tests, work samples and other measures *VEs* use in daily practice to measure individual abilities/capacities are clearly scientific. Most have known reliability, validity and error rates. Some would argue that social science is not "hard" science, such as chemistry or physics, because social scientists have less control of all the variables hard sciences would have (Williams, 1998). Nevertheless, measurement of critical vocational variables is part and parcel of a vocational evaluation and constitutes scientific method. As Thorndike and Hagen (1969) noted:

> *"If a thing exists, it exists in some amount. And, if it exists in some amount, it can be measured."*

Measurement applies to such vocational variables as aptitudes, intelligence, academic skills, behaviors, interests, temperaments, and a host of other relevant factors, including transferable skills, employability and earning capacity. Technical and specialized knowledge are also employed in daily rehabilitation practice, in terms of labor market information, job analyses, rehabilitation planning, life care planning, reasonable accommodations, assistive technologies and several other factors that do not lend themselves as readily to measurement. Under a *Daubert/Kumho* court challenge, these issues could be problematic insofar as they may not have a theoretical basis, a known error rate or haven't been tested, thereby leaving open potential questions attacking their reliability and validity.

Dating back to Dr. Frank Parsons (1909), widely recognized as the *"father" of vocational guidance*, and the vocational evaluation movement since Parsons, one would be forced to conclude that science and social scientific methods have been the traditional and dominant forces in our profession. Parsons, who practiced only a few years, laid out three rather simple criteria for a scientific approach to vocational guidance:

1. *A knowledge of the requirements and conditions for success in different lines of work, as well as related advantages, disadvantages, compensation, opportunities, and prospects (Knowledge of the world of work).*
2. *A clear understanding of the aptitudes, interests, ambitions, resources and limitations of the individual (Knowledge of self; insight into oneself).*
3. *Systematic techniques for integrating these two sources of information in the vocational decision making process (Scientific reasoning on comparing these two sets of facts).* (Streater, 1987).

A standard text in vocational evaluation at the graduate level was the seminal work of Super and Crites (1949, 1962), the title of which noted that vocational fitness was to be appraised using standardized psychometric tests. The mid-1950's and well into the 1970's witnessed a strong social scientific testing movement, beginning with what became known as the *Minnesota Studies in Vocational Rehabilitation* that culminated in development of the *Minnesota Theory of Work Adjustment* (Dawis, England and Lofquist, 1964). By the mid-1970's this had been manually "operationalized" with the development of the *VDARE Process* (McCroskey, Wattenbarger, Field and Sink 1977), which formed the initial basis for virtually all computerized job-person matching systems that followed. All involve quantitative measurement - some to a greater degree than others.

The *Vocational Evaluation and Work Adjustment Association* (VEWAA) has roots in the first vocational rehabilitation research institute that received federal funding - the *Materials Development Center* at the University of Wisconsin - Stout. The program at University of Wisconsin - Stout produced the first graduate level degree specifically in *Vocational Evaluation*, with a decidedly quantitative scientific research orientation. Professors in the graduate program at the University of Arizona produced the *Valpar Component Work Samples* (Valpar, 1974), which employed scientific measurement and assessment.

The Rehabilitation Counseling Bulletin and the *Journal of Applied Rehabilitation Counseling* are the preeminent professional journals in our profession and both have a strong scientific orientation. These peer-reviewed publications frequently contain works of such prolific writers and researchers as Brian Bolton, Nancy Crewe, Randall Parker, Lawrence Hartlage, David Hershenson, Stanford Rubin and many others, which further attest to the overwhelming dominance of social scientific orientation of those involved in assessing vocational outcomes in vocational rehabilitation and career counseling.

The private sector *Journal of Forensic Vocationology* (JOFV, Volumes 1-6, 1995-2000), the American Board of Vocational Expert's *Journal of Forensic Vocational Analysis* (JOFVA, Volumes 1-4, 1997-2000) and the American

Rehabilitation Economics Association's *The Earnings Analyst* (TEA, Volumes 1-4, 1998-2001) have each appeared on the scene since 1995. These are national, relatively small peer-reviewed, *specialty journals* specifically started up to help address the needs of vocational and rehabilitation economic experts in terms of repositories for scientific articles for our overlapping fields of expertise.

Mayer (1999, pp. 37-74) provided us with an excellent annotated bibliography of important topics in forensic vocational knowledge and applications related to the *1998 Updated 3rd Edition ABVE Examination* (McCroskey, Lageman, Streater, Peterson, Stein, Mayer, and Dennis, 1999). The *References and Bibliography* section of this article contains a sampling of Dr. Mayer's bibliography of suggested reading references.

Although social scientific method has dominated the profession, scientific method cannot deny, ignore or minimize the work of qualitative researchers in the field of vocational rehabilitation and their contributions. A good example is the seminal work of Paul Deutsch, who has pioneered the field of *Life-Care Planning*. There are many others. Of equal importance is the emergence and impact of assistive technologies, which need to be addressed in any vocational evaluation. Lown and Langton (1995) are among those who argue that:

> *The traditional approach to vocational evaluation was probably valid when it* was *first conceptualized. However, with continuing rapid advances in technology, this approach can no longer be justified as the only method.*

Consideration of assistive technologies and accommodations, *Life-Care Planning* and other pragmatic issues are not totally incompatible with measurement in determining performance and outcomes derived using applied social scientific methods, including determination of error rates, validity and reliability, thereby enabling *Daubert* standards to be met to a large degree.

Scientific Experimental/Controlled Research Designs and Analyses are always preferable, whenever possible, as they help us understand *Cause and Effect* relationships. *Regression Analysis Research Designs and Analyses* help us scientifically establish *Reliability* and *Predictive Validity (R_{xy}) Coefficients*, *Standard Errors of Measure* (*SE_M*-associated with our *Predictor Measurement Errors*) and *Standard Errors of Estimate* (*SE_E*-associated with our *Criterion-Related Prediction Errors*). *Inter-Rater Reliability Coefficients*, which are also very important to scientific reliability, are developed using related, well-established, scientific statistical analyses (Ebel, 1951).

Alternative *Research Designs and Analyses* should be avoided and used only if true scientific conditions cannot be established. However, a word of caution must be noted: If using an alternative, *non-scientific approach*, ***an expert will need to make more assumptions, will have less certainty and will be less precise about what the results mean*** (Schalock, 2001). When questioned under oath about the ***reliability*** or ***validity*** of **results/outcomes** derived from using such methods, ***the expert will be at much greater risk to challenge and disallowing of testimony***. It should be noted that **one successful challenge to your methodology, with the result that your testimony is disallowed, "*could become the defining moment in one's professional life*"** (Field, et. al., 2000).

Standards and Problems with Vocational Information

Since the emergence of job-person matching employing first the *VDARE Process* (McCroskey, et. al., 1977), and later computerized systems, nearly all *VEs* have used the worker trait factors defined in the *Dictionary of Occupational Titles, (DOT), 3rd, 4th and 4th Edition Revised* (US DOL 1965, 1966, 1968, 1977, 1991a & 1991b). Selected *Worker Trait Characteristics of Occupations* defined in the supplements to *Dictionary of Occupational Titles,* (US DOL 1966, 1968 & 1991), along with privately published data derived from US Department of Labor (US DOL) sources, have been the *unofficial standard*. In the case of the *Social Security Disability* program, have become and remain the *official standard*. Most practicing *VEs* agree that this much of this data is now outdated, to the point of being archival history.

In 1998, in an effort to replace the DOT, the USDOL introduced the *Occupational Information Network* (O*NET-98), which remains *incomplete* and *incompatible* with prior DOT systems data paradigms. In terms of making valid and reliable vocational determinations, O*NET-98 has been found to be *so lacking* that the *Social Security Administration, Office of Disability* issued the following directive in an undated memorandum from Kenneth D. Nibali, *Associate Commissioner for Disability*, sometime during the year 2000-2001 period:

> "At this time, the prototype version of O*NET does not provide any advantage over the DOT (or other existing vocational resources). Therefore, DDSs and other SSA disability adjudicators and reviewers should not use O*NET when making disability decisions" (Nibali, c. 2000-2001).

The Nibali memorandum further stated:

> "We recognize the need to find alternatives to the DOT, which is no longer being updated. However, we must also insure that any alternative and our regulations are compatible for use in making supportable determinations of disability" (Nibali, c. 2000-2001).

The dilemma for most *VEs,* dealing with both the *Social Security Disability* program and *Civil Court* tort cases, is a choice between using a source of significantly *outdated information* (the DOT), or using its *incomplete* and *incompatible* replacement (O*NET-98). This dilemma would appear to provide enough cannon fodder for either *defense* or *plaintiff* attorneys to seriously question any vocational determinations presented by most vocational experts in any court of law where the expert is subject to *Daubert Standards,* or similar foundational questioning by defense or plaintiff attorneys.

Applying Science

Having briefly defined and broadly outlined problems with the 4th Edition DOT (*outdatedness*), we now have the 1998 O*NET database, which also has significant problems (*unrelatedness/incompleteness*). The question now arises: How do *VEs* resolve these problems and provide a valid and reliable (i.e. scientific) source of vocationally relevant information for rendering accurate determinations on issues related to individual employability, transferable job skills and wage earning capacity? In view of the *Social Security Disability* program's inability and refusal to utilize the O*NET-98 data due to its incompleteness, lack of accurate transferable skills analysis and taxonomy

that eliminated statutorily required data (i.e. SVP), McCroskey (2000) conducted research aimed at incorporating the best of the O*NET-98 data to bridge the gap and update the best of the 1991 DOT data to a *5th Edition Updated DOT*, while retaining much of the 1991 DOT taxonomy.

Employing a series of multiple regression analyses and related advanced statistical data mining and data fusion procedures and techniques consistent with forensic and professional standards (Rubinfeld, 1994), McCroskey (2000) derived what he terms "Part 2 of the 5th Edition Dictionary of Occupational Titles" (Part I was the O*NET-98 data in its current form). While some may criticize private research assuming the role held by the US Department of Labor, the proof lies in the reliability and validity of what was produced, not the producer. Independent research to validate what was produced in this updated version has already commenced and initial results have been very promising. Thus far, studies have resulted in articles being published in two professional, peer-reviewed journals. Both articles reported ***high levels*** of reliability and validity (Grimley, Williams, Hahn & Dennis, 2000a, 2000b, and McCroskey, Hahn & Dennis, 2000).

The task of revising and updating the DOT, including O*NET data elements, was an enormous undertaking and required a yeoman's effort. A look at the data analysis helps to understand the magnitude of the research conducted, the demonstrated results, and the scientific significance of fusing the *75 most vocationally significant O*NET-98 worker trait elements* with the *24 most vocationally significant 1991 DOT worker traits*. Those results were reported and published in *MVQS 2001 Resources* (McCroskey, 2001).

As noted, *O*NET-98* utilized an entirely different taxonomy than the *4th Edition DOT*, which created as many problems for research as it did for *Social Security Disability* determinations. The most critical change that the O*NET employed were qualitative statements to describe aggregate or general job duties, while the DOT had employed a quantitative trait factor classification system. The problem is how to "mine" the O*NET data and extract accurate information that could be reconstructed using the DOT taxonomy? A simple procedure would be to cross walk different occupational codes, but this would not effectively bridge the gap between *quantitative* and *qualitative* required to enable job-person matching at the job specific level, with any reasonable degree of accuracy, not to mention scientific reliability and validity.

The O*NET developed *Occupational Unit Classification (OUC) code-based transferable skills groups*, which were derived from the *Occupational Employment Statistics (OES) Codes*. These were studied empirically using cluster analysis as a means of establishing the O*NET 1998 Transferable Skills (TS) Groups. Belongingness and homogeneity were achieved using the variables previously used by the US Department of Labor (USDOL), including MPSMS (Materials, Products, Subject Matter and Services); MTEWA (Work Field, Machines, Tools, Equipment and Work Aids); SVP (Specific Vocational Preparation); and others (28 variables in all).

The biggest problem with the O*NET, as developed by the USDOL, was that, as a replacement for the DOT, the USDOL did not adequately consider the needs of VEs as primary users of the DOT. As a result, USDOL and the Social Security Administration (SSA) have been trying to devise a way for compatibility to be achieved. While they have negotiated and discussed various ways to arrive at compatibility, they have failed to reach a consensus. On the other hand, McCroskey and Dennis (2000) essentially described what McCroskey (2000) achieved, and what the USDOL should have completed: *An Updated and Expanded 5th Edition DOT, with Job-Person Job Demand/Worker Trait*

Capacity Requirement Profiles, specific to each of the 12,775 Job Types described in the MVQS 2001 McCroskey Dictionary of Occupational Titles (McDOT, McCroskey, 2001).

A detailed review of the information in *MVQS 2001 Resources* (McCroskey, 2001, pp 45-61) shows that inclusion of both DOT *worker traits* and O*NET 98 *trait elements* fused into the 24 *most vocationally significant* worker traits has resulted in job specific worker trait profiles for 12,775 jobs with *high predictive validity coefficients* for all updated worker traits, as well as for the reconstituted *Specific Vocational Preparation* (SVP) and *Vocational Quotient* (VQ) variables (e.g., R_{xy}=0.97 for VQ and 0.90 for SVP).

To fuse selected *1991 DOT data* with selected *1998 O*NET-98 data*, McCroskey and Dennis (2000) described a required expansion of the old DOT data paradigm to include primary, secondary and tertiary codes, data, people, things and four temperaments, along with reconstituted and updated worker traits for reasoning, math and language, the eleven aptitudes, the six physical demands and the seven environmental conditions from the 1991 DOT paradigm. The resultant data fusion process incorporated the 24 most vocationally significant worker traits from the *1991 4th Edition Revised DOT* as predictors of the 75 *most vocationally significant* worker trait "element-level" data from the *O*NET-98* data, which, in turn, were used as predictors of the updated and expanded 24 *most vocationally significant* worker traits, VQ, SVP and Zone, which were included in the *MVQS 2000 and 2001 Job-Person Matching Programs* (McCroskey, 2000, 2001). This type of data fusion was essential in view of the new *Transferable Skills* component in *O*NET-98* and the need for reliable and valid measurement in the assessment of transferable skills, six-point earning capacity predictions and related vocational issues.

The Case for Using the Scientific Method in Forensic Vocational Evaluation

In an article by Weed (2000), there appeared to be a somewhat disturbing advocacy for use of a *non-scientific* approach in forensic vocational evaluation. Although what initially appeared to be billed as "a common sense approach" versus "a scientific approach", what was actually being described was the "*R.A.P.E.L. Pneumonic*", which constitutes a well-ordered framework for the rehabilitation process, as opposed to a specific "method." Assuming that to be the case, the ***methods*** used ***within the R.A.P.E.L. Pneumonic****,* versus the ***R.A.P.E.L. Pneumonic itself***, would bear the brunt of the responsibility for meeting the *Daubert Standards* for reliability, validity and error rates.

The mathematician and philosopher Alfred North Whitehead (1911) warned that common sense has as its sole criteria for judgment "*that new ideas shall look like old ones*." This is as clear today as it was in 1911.

Indeed, *common sense* is a bad master for the evaluation of knowledge and information and *VEs* would be well advised to reject the notion of simply using a *common sense* approach, in favor of a *scientific* approach to vocational evaluation and expert testimony, in light of *Daubert*, *Joiner* and *Kumho,* and the clear intent of these US Supreme Court decisions. Kerlinger (1973) reminded us that ***science*** and ***common sense*** differ in critical and substantial ways that *VEs* need to be very familiar with:

1. *Science systematically builds theoretical structures, tests them for internal consistency and subjects them to empirical testing. Common sense often casually accepts fanciful explanations of human phenomena.*

2. *Science systematically and empirically tests theories and hypotheses. Common sense tests hypotheses in a selective manner, often "selecting' evidence simply because it is consistent with an accepted hypothesis.*
3. *Science uses systematic control to rule out variables that are possible "causes" other than those hypothesized to be the "causes." Common sense explanations rarely employ controls to explain "causes" of observed behavior.*
   Science deals with variables that can be observed and tested. Common sense deals with metaphysical explanations that cannot.
4. *Science consciously and systematically pursues relationships of behavioral phenomena. Common sense has only a loose, unsystematic and uncontrolled preoccupation with behavioral phenomena* (Kerlinger, 1973).

Vocational evaluation/assessment in the forensic setting requires *VEs* to provide information regarding such serious matters as individual employability (also referred to as labor market access); wage earning capacity/loss of earning capacity; transferability of job skills; job placement and training potential; reasonable accommodations and assistive technologies; and many other related issues of equal importance, Field, et al (2000). The methodology used must meet the primary criteria laid out by the US Supreme Court in *Daubert* (1993), *Joiner* (1996) and *Kumho Tire* (1999). A simple way of evaluating whether or not your method measures up to the established criteria is to ask yourself four basic *Daubert* questions:

1. Has your method been independently tested and is it scientifically reliable?
2. Has your method been subjected to peer review and published in a peer-reviewed journal?
3. What is the known error rate of your method and what standards does it use?
4. Is your method commonly used and generally accepted in the field?

Attempting to gloss over the need for science, particularly the need for validity and reliability, in the method of arriving at conclusions is no longer viable. Weed (2000) and Field (2000) contend that having supporting documentation and being able to cite journal articles at time of trial is sufficient to withstand a *Daubert*
challenge. However, not having a scientifically reliable basis for the opinion is risky and borders on being dangerous. Remember, as a practicing VE if your testimony is disallowed just one time, chances are you will hear about that one time every single time you're called on to provide testimony at trial, deposition, or both. "Common sense" should tell anyone that the US Supreme Court wants ***scientific reliability***, nothing less. Shahnasarian and Lassiter (2002) reiterate

that the *Daubert* case provides the most compelling basis for concluding that opinions expressed by *VEs* be derived by the scientific method.

Conclusions

Methodological implications of scientifically based vocational research are significant for *VEs* who wish to conduct valid job-person matching and use the scientific method to produce valid and reliable results from updated vocational information. While Social Security reverts back to the 4th Edition DOT and the USDOL moves slowly in its incompatible O*NET endeavor, social scientific methods backed by empirical research exist and should be given priority for any VE involved in a forensic vocational evaluation.

Methods that have been independently verified, tried and tested are now the criteria, as defined by the US Supreme Court. To consider going to court with any methodology that does not meet at least the basic *Daubert* criteria noted could be ruinous to a VE's career. To meet the Court mandated *Daubert* criteria, neither a "common sense" approach nor efforts at methodological pluralism, reliance on a pneumonic, or even partial compliance will suffice. ***Scientific method is clearly required***.

Finally, of great importance is the continuing need for independent scholarship to provide answers using applied social scientific method to meet the US Supreme Court standards mandated in the landmark case decisions discussed herein. To wait for US Government agencies to produce useable data has proven unrealistic. Despite criticism, a few *VEs* have "dared to lead where angels fear to tread." (With apologies to E. M. Forster and Jerry Garcia).

The O*NET, in all likelihood, will not be completed in a useable format for several years to come, if ever. O*NET has thus far failed to adequately consider the needs of practicing *VEs*, who were the most frequent users of its precursor, the DOT. This has been most unfortunate, but is a reality with which all *VEs* must deal. The most important reality is that the highest Court in the land has clearly ruled that analyses and related expert testimony underpinned with *scientific reliability and validity* are admissible, and that anything less fails to constitute reliable expert knowledge that would be helpful to judges and jurors. Regardless of whether a VE provides documentation or even peer-reviewed articles from journals, without an *empirically supportable "reliable" foundation* underpinning their methodology, a *VE's* conclusions can, should and most likely will be challenged.

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