Scientific Prediction of Transferable Skills

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Abstract
The McCroskey Transferable Skills Program (MTSP 2000) Transferable Skills Percent (TSP) scale was found to be a valid predictor of the averaged responses of 93 Vocational Experts tested using the ABVE Transferable Skills Evaluation Test1 instrument. The Predictive Validity Coefficient between the MTSP 2000 TSP rankings and the criterion-referenced Prediction Estimates of the Vocational Experts (N=93) was extremely high (R\text{xy} = 0.96). Correspondingly, the Coefficient Of Determination (R^2 = 0.92) was extremely high. Finally, the Standard Error of Estimate (SE_E = 0.357) was found to be very reasonable.

Introduction
Transferable Skills are those skills (knowledge and abilities) that are common between two or more jobs. The McCroskey Transferable Skills Program (MTSP 2000) software provides a Transferable Skills Percent (TSP) ranking that rates jobs on a scale from 0 to 97% in terms of transferable skills. The core database used for the MTSP TSP scale was O*NET 98\textsuperscript{2} and all the variable and mathematical models used to produce the O*NET 98 core transferable skill groups database. This ranking has been very helpful in providing realistic information to clients, but the predictive validity of the MTSP 2000 TSP scale had not yet been empirically tested. This research provided such a test by comparing the MTSP 2000 TSP rankings with the averaged rankings of 93 Vocational Experts, through the use of the ABVE Transferable Skills Evaluation Test instrument. This evaluation instrument was developed from the MTSP 2000 algorithm (which partially incorporated the O*NET 98 Transferable Skills groupings paradigm) and was administered to 93 Vocational Experts at the ABVE 2000 Spring Conference in New Orleans, LA.

Literature Review
Decision-making about loss of earning capacity in civil litigation, as well as appropriate job placement for persons with or without disabilities, for vocational rehabilitation counselors and vocational experts has been based, at least in part, on transferable skills

1 The ABVE Transferable Skills Evaluation Test (McCroskey & Dennis, 2000) was specifically developed for this study to empirically determine the reliability, predictive validity and error rate for the MTSP 2000 Transferable Skills Percent relative to the opinions of Vocational Experts (N=93) through scientific research. Predictive validity (R\text{xy}) between the two variables was 0.96; the coefficient of determination (R^2) was 0.92, and the standard error of estimate (SE_E) was 0.357.

2 O*NET 98 - The Occupational Information Network Version 1.0 (United States Department of Labor Employment and Training Administration, 1998).
analysis (TSA; Williams and Maze, 1994; Maze & Williams, 1993). In theory and in practice, assessment of transferable skills acquired through work or education has been seen as an effective method for identifying what occupations an individual can successfully perform, and to a lesser degree, what occupations employers believe an individual has the ability to competitively perform (i.e., those jobs the person would typically be successful in and be able to earn wages typically associated therewith).

Landsea (1994) pointed out that it is the individual-specific factors like age, education, gender, occupation, industry, and geographical location which effect the growth of one’s earnings over lifespan, suggesting a linkage between acquired knowledge and skills and lifetime earnings. Therefore, it is not surprising that transferability of skills has been seen by vocational experts in civil litigation and counselors working with those in need of career counseling as a way of determining the suitability of specific occupations for a given individual and the impact of these occupational choices on earnings.

Cutler, Cutler and Ramm (1995) pointed out that transferability of skills methodologies offered in such software as RAVE, OAYSIS, VALE, or Labor Market Access Plus were commonly used by vocational experts and rehabilitation counselors to identify specific occupations and earnings without any real understanding of the limitations of the data. They opined that use of the Dictionary of Occupational Titles (U.S. Dept of Labor, 1991) as the basis for identifying the skills and functional capacities associated with jobs was problematic due to the age of the data. Likewise, frequency of jobs by occupation (the basis for determining loss of number of jobs to which one had access pre- and post-injury) was not considered to be entirely accurate because of reliance on aggregate census data. However, they missed the most fundamental question of the validity of the concept of transferable skills (i.e., construct as opposed to content validity).

Williams (1998) stated that computer programs based on DOT (1991) run the risk of not controlling for methodological error variance if not basing the sorting functions of the software on the appropriate factors. He went on to explain that the Revised Handbook for Analyzing Jobs (1991) listed three variables that were relevant to assessment of transferable skills (Work Fields, MPSMS and Specific Vocational Preparation or SVP).

Work Fields are Machine, Tools, Equipment and Work Aids (MTEWA) grouping codes that reflect how work gets done, the result of work, and the purpose of the job. Although these categories range from specific to general, they represent homogeneous groups related to technologies or objectives. It is easy to justify the inclusion of Work Fields into a Transferable Skills Analysis. People can acquire skills in getting work done, and these skills can be transferred to another job.

Materials, Products, Subject Matter, and Services (MPSMS) grouping codes describe what a worker does and what gets done to what. This coding structure is similar to the Work Fields structure, and its use in Transferable Skills Analysis appears logical. Skills related to what the worker does and how this work is completed can realistically be transferred to another job.
Specific Vocational Preparation (SVP) is the amount of lapsed time required for a typical worker to learn the techniques, acquire the information, and develop the facility needed for average performance in a specific job-worker situation. Use of SVP as a selection variable in transferability of skills analysis (TSA) assumes that the individual can perform all occupations which have the same or lower SVP. Since SVP represents time required to learn a job and not any inherent knowledge and/or skills associated with the job, SVP cannot be transferred from job to job. However, SVP is highly correlated with Reasoning (R), Math (M) and Language (L) Development, factors that can be identified in individuals and job requirements. Therefore, these factors may be more predictive of ability to perform specific job tasks than SVP alone. Use of SVP as a discriminator of what jobs are screened out during a TSA may not make sense when R, M, or L Development are not considered. This is particularly true when injured persons are limited by physical and/or mental impairments to sedentary or light work where the preponderance of jobs require higher SVP levels than many medium or higher exertion level occupations. SVP alone may be overly exclusive.

Use of a more appropriate variable like Vocational Quotient (VQ) as an index of job difficulty/work capacity may help overcome the limitations of conventional thinking about transferability of skills. The McCroskey Transferable Skills Program (MTSP 2000) uses the VQ index of job difficulty/personal capacity to define vocationally significant worker capacities and job requirements. By weighting the complexity and difficulty of job titles, the VQ provides an appropriate control on academic, intellectual, attending, and related skills. It has also been validated in numerous empirical studies (McCroskey, 1981, 2000; McCroskey & Hahn 1997; 1998a; 1998b) and found to be a valid predictor for the middle of the income distribution. Using the VQ rather than inappropriate variables (such as SVP) can prevent indefensible explanations for TSA.

O*NET Groups and Transferable Skills Analysis

The O*NET Viewer contains its own, very crudely defined, transferable skills analysis module (Related Occupations module option), which does not represent actual occupations (Dennis & McCroskey, 1999). Instead, it represents fairly large groupings of possibly related (and often unrelated) O*NET or Occupational Unit (OU) Classification coded groups of jobs. Suitably related jobs can be found in the O*NET, but the information provided in the Related Occupations module can only be used in the most general terms. For example, the OU code of 34002E is Managing Editors. Related Occupations listed Book Editors (34002G), Program Directors (34056H), Audiovisual Specialists (31508), Producers (31511C), Technical Writers (34005), and Museum Research Workers (31511C). The connection between some of these OU groupings is fairly clear. However, it also listed (as part of its up to 10 groupings) Employee Relations Specialist (21511C) as being related. It can be seen that the OU code changed from starting with a 3, to starting with a 2. It would be hard to explain how the skills could be easily transferred. Other occupations included were First Line Supervisors, Administrative Support (51002B) and Appraisers, Real Estate (43011). Except for getting people to draw pictures of houses for the newspaper, it is difficult to understand what skills would transfer from a Managing Editor to a Real Estate Appraiser.
The O*NET categories were created by mathematically grouping jobs that had similar requirements and excluding other job groupings that were not similar. O*NET 98 OU codes, however, were either too broad or too narrow (on their own) to use as stand-alone transferable skills groupings. Adding the O*NET database (OU) codes as a major component of its transferable skills analysis algorithm, has improved the ability of the 1998 McCroskey Transferable Skills Program (MTSP 2000) to distinguish occupations truly related by reasonable transferability of skills. Face, Content and Construct Validity are much more apparent in the new MTSP 2000 program than in the stand-alone O*NET 98 OU code groupings themselves. The clarity of the new MTSP transferable skills algorithm has allowed the MTSP transferability scale to be converted from its previous 1 to 46 level Raw Score Scale to a straight Transferability Skill Percent (TSP) scale. MTSP 2000 users have found the percentage based TSP Rated Outputs for MTSP Job Matches much more intuitive, understandable, easier to interpret and easier to explain, thus easier to defend.

TSA software programs are now faced with the challenge of integrating O*NET data with traditional DOT data to predict actual jobs an individual can perform and the level of expected earnings associated with these selected occupations. Traditional thinking about TSA (Williams, 1998) and the enhancements offered by the Vocational Quotient (VQ) (McCroskey, 1981, 2000; McCroskey & Hahn 1997; 1998a; 1998b) must lead vocational experts and counselors to ask the less technical and possibly more initially critical question of whether or not the construct of transferable skills has been sufficiently understood and explained to the professional community that sufficient consensus on what this construct means and how it should be used in TSA software has been developed. Without construct validity TSA software will have little value to predict suitable jobs and associated earnings. To the end of determining if transferable skills is a meaningful construct that can be used reliably to predict suitable occupations for individuals (i.e., predictive validity), the following study is a meaningful first step. If expert opinion and the results of TSA software are shown to be consistent one could argue the concurrent validity of the software and vocational expert opinion. The study assesses the concurrent validity between vocational expert opinions and the results of the McCroskey Transferable Skills Program (MTSP 2000) and supports the construct validity of transferability of skills.

**Methodology**

**Subjects**

The subjects (N = 93) were a subset of the people attending the ABVE Spring 2000 conference in New Orleans, LA (Brethauer, 2000). There were approximately 140 people in attendance for the conference. Two of the original responses were not included because of invalid responding. The same numbers were used for different job titles. Only those who considered themselves to be Vocational Experts (VEs) were asked to complete the test. The average age of respondents was 50.71 years. Males comprised 54 percent of the VE sample and females made up 46 percent of the sample. The average level of education of the sample was Greater-Than-a-Masters-Degree. The average experience level of the sample was 16.57 years. This sample focused on attendees of advanced
educational training for VEs. Only those confirming themselves to be VEs completed the test. Sample size was large and assumed representative of the overall VE population.

**Transferable Skills Model**

The *McCroskey Transferable Skills Program* (MTSP 2000) uses a combination model to produce the Transferable Skills Percent. Numerical values are accumulated in the program to produce a theoretical representation of the percent of total skills that are transferable. The highest level is 97 percent. This level is reached when a person reenters the same job title. The 97 percent level assumes that even when an individual secures a job with the same title, there are subtle differences, either temporally or between companies or work sites that need to be learned before the worker can be expected to perform all 100 percent of the essential job tasks.

If the target job title has a Vocational Quotient (VQ) less than 85, the job is considered unskilled, and the Transferable Skills Percent is zero (0). If the VQ is 85 or greater, the program evaluates similarities between the work history reference and target job titles. The Transferable Skills Percent (TSP) accumulates a two digit value. The first digit (tens value) represents the job similarities on the DOT and O*NET coding systems. Only those jobs that match the profile of the reference occupation on the McDOT 2000 (McCroskey, 2000) database are considered. MTSP 2000 matches people with jobs on the 24 most vocationally significant McDOT variables. Only target jobs which match the worker's evaluative data profile on the 24 most vocationally significant variables extracted from McDOT 2000 are considered during the MTSP 2000 Transferable Skills Analysis. Comparison on the O*NET produces a similar comparison on 28 vocational variables. Briefly, the MTSP Transferable Skills Percent rankings are described below.

The first digit (tens value)
- The highest TSP levels (80 - 97%) require the target job to match the reference job on the first 3 digits of the McDOT 2000 code and all 5 or 6 of the O*NET code.
- The next TSP level (60 - 79%), the two jobs must match either the first 3 digits of the McDOT 2000 code or all 5 or 6 digits of the O*NET code. Or, match the first 2 digits on the McDOT 2000 code and the first 4 digits of the O*NET code.
- To acquire the third level of TSP, the jobs must match either the first 2 digits of the McDOT 2000 code or the first 4 digits of the O*NET code. Or, match the first digit of McDOT 2000 code and the first 2 digits of the O*NET code.

The second digit (ones value) is a direct accumulation for matching on codes from six crosswalk databases. This digit is incremented for each match of the two jobs on the following codes:

- Standard Industrial Classification (SIC)
- Standard Occupational Classification (SOC)
- Census Code (CEN)
- Materials, Product, Subject Matter, and Services (MPSMS)
- Work Field (WF1)
- Industry (IND)
The total TSP score is mathematically transformed to produce a total percent of the available points possible. This transformation only goes to a total possible percent of 97 to represent the theoretical concept that while no two jobs are ever 100 percent identical, they may approach unity. Ultimately, the TSP is a percent based on 58 vocational variables including 24 McDOT 2000 variables, 28 O*NET variables and 6 additional vocational crosswalk databases. The following subjective ratings were attributed to the objective TSP rankings, and they matched the rankings on the ABVE Transferable Skills Evaluation instrument.

1. 0 - 19% = an unskilled job with no significant transferable skills
2. 20 - 39% = a semi-skilled to skilled job with no significant transferable skills
3. 40 - 59% = a semi-skilled to skilled job with low transferable skills
4. 60 - 79% = a semi-skilled to skilled job with moderate transferable skills
5. 80 - 97% = a semi-skilled to skilled job with high transferable skills

**Instrument**

The McCroskey Transferable Skills Program (MTSP 2000) was run against representative jobs from the McCroskey Dictionary of Occupational Titles (McDOT 2000). One job was picked from each of the ten major occupational groupings (0 through 9). One at a time, these jobs were used in a simulated MTSP 2000 Work History Transferable Skills Analysis. Each stimulus job became part of the stem of a rank-order question. The jobs produced by MTSP 2000 were sorted in order of their Transferable Skills Percent. Five job titles from these listings were randomly selected to produce each set of the five options for each question of the ABVE Transferable Skills Evaluation Test instrument (McCroskey & Dennis, 2000). The order given by the MTSP 2000 software was randomly assigned to avoid a pattern on the 10 questions. The items were numbered from 0 to 9 to represent the major job grouping covered by each item. The following ratings were used for the test.

- A rating of 5 = a semi-skilled to skilled job with high transferable skills
- A rating of 4 = a semi-skilled to skilled job with moderate transferable skills
- A rating of 3 = a semi-skilled to skilled job with low transferable skills
- A rating of 2 = a semi-skilled to skilled job with no significant transferable skills
- A rating of 1 = an unskilled job with no significant transferable skills

**Example Question on the ABVE Transferable Skills Evaluation Test**

A *Plumber* is seeking new employment. Rank the following jobs options from 1 to 5 (Lowest to Highest Transferable Skills) relative to this person's *Plumber* occupation.

__ Carcass Washer
__ Sewer Line Repairer
__ Plumber
__ Pipefitter
__ Sheet Metal Repairer
Demographic information was also collected that included age, sex, primary occupation, highest educational level, and the number of years the person has worked as a Vocational Expert.

Procedure
The ABVE Transferable Skills Evaluation Test was administered to conference attendees considered to be Vocational Experts, at the beginning of the Pre-Conference Workshop and at the beginning of the main Conference Workshop. Dr. McCroskey and Dr. Stein presented these workshops as part of the ABVE Spring 2000 Conference in New Orleans. Ms. Grimley individually handed out the test to all participants. She instructed them to rank order each set of five jobs as to the degree of transferability relative to the stimulus job. Attendees of both workshops were asked to only take the test one time. It took about 10 minutes for the sample to provide demographic information and complete the test. Ms. Grimley collected and verified the return of the complete set of instruments.

Results
A comparison between the MTSP 2000 rankings and the average response by the Vocational Experts showed an extremely high level of relationship across the 50 items on the ABVE Transferable Skills Evaluation instrument. The predictive validity coefficient ($R_{xy}$) between the two variables was 0.96, and the coefficient of determination ($R^2$) was 0.92. Linear Regression output showed a standard error of $Y$-estimate of 0.357. The MTSP 2000 ranking of the Transferable Skills Percent predicted 92 percent of the variance in the average Vocational Expert response. The regression formula to predict the average Vocational Expert response ($Y$) from the MTSP 2000 ranking ($X$) was:

$$Y = 0.43913 + 0.852826(X) + 0.035702$$

The following graph (MSTP Prediction) shows the measured relationship between the MTSP ranking and the ranking given by the average Vocational Expert. The graph has 10 points for each level (one for each DOT Occupational Category). The responses were first sorted in order of MTSP prediction across the five possible levels (from level 1: unskilled jobs with no transferable skills; to level 5: jobs with the very high level transferable skills). That is, all the one level responses were sorted in order before all the two level responses. A second sort (across Occupational Categories) placed the job title groupings (from Occupational Category 0 to 9) in order within each level.

In reviewing the graph, it is clear that most of the variability was in the level two (semi-skilled to skilled jobs with no transferable skills) and level three (semi-skilled to skilled jobs with low levels of transferable skills) responses. Vocational Experts were more consistent with MTSP predictions when the examples had high to moderate transferable skills (levels 5 and 4) and represented semi-skilled to skilled work, or when the jobs were unskilled and had no transferable skills (level 1).
Discussion and Conclusions

The results of this study support the construct validity of transferability of skills as well as the concurrent validity of the McCroskey Transferable Skills Program (MTSP 2000). At least on this one occasion it appears that there is professional consensus about what the construct of transferability of skills entails and methodological consensus between experts and software about TSA results. Since 92% of the variance in expert response was controlled by the software, consensus about the theoretical construct and the standardized TSA methodology are embodied within the MTSP 2000 software. Dennis and Dennis (1998) asked if any TSA software would stand the scrutiny of the Daubert standard for admissibility of expert testimony in federal court. These authors were collaterally asking if any TSA software, with its strengths and limitations, was a valuable tool for making decisions about jobs and earning capacity in life as well as civil court.

If TSA software methodologies are to meet the standard of science that is possible (given that the behavioral sciences typically lack the inherent control of error variance found in the natural sciences) and are to be recognized as a valid predictors of realistic job options and earning capacity for persons with or without disabilities, continued research on the validity of TSA methodologies needs to occur.

This study strongly suggests that vocational experts and MTSP 2000 TSA software agree on the parameters and outcomes embodied in the MTSP 2000 TSA and TSP methodology. This enhances the credibility of both as reliable tools for assisting clients, fact-finders and other interested parties, in reliable, valid, reasonable decision-making.
References and Bibliography


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