

Evaluating MRM Programs: A New Method and Tool

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I. The Use of Company- and Department-Level Percentile Ranks in Industry-Wide Organization Research

A common method of evaluating organizational success is by comparison to other organizations within the same industry. When data are collected from a number of companies with similar function or purpose, an organization can be placed along the distribution of all the companies and assigned a percentile rank. This ranking indicates where a particular organization ranks among its industry peers. This paper provides a basic description of percentile ranks, and discusses the practical implications of their use in organization research.

The Nature of Percentile Ranks

Percentile ranks are a descriptive measure derived from standard scores that identify the location of an individual or subgroup along a distribution of a larger population to which that individual or group belongs (see Downie & Heath, 1974). Such measures have typically been used on standardized individual achievement tests, where results are to be interpreted in the context of the population to which the test-taker belongs. Application to organizations and group scores on standardized attitude surveys presents another valid use of percentiles. Percentile ranks in organization research can act as an indicator of where a company or department resides among its industry peers, but not necessarily as an indicator of individual or group improvement.

Why Percentile Ranks?

Percentile ranks are appropriate for industry-wide organizational research for much the same reason they are used in clinical and educational settings: The desire for a benchmarked comparison of individual performance. Rather than showing how much a company has changed over time (as with longitudinal means comparisons), percentile ranks calculator show the position of a company in the industry at a particular point in time. Both pieces of information are important, but different, and provide a richer assessment of cultural or technical change when taken together.

Interpretation of Percentile Ranks

A few basic rules exist in the interpretation of percentile ranks. Percentile ranks range from 0 to 100, with higher ranks indicating a larger portion of the distribution of

scores falling below the individual or group in question. Brown (1991) offers cautionary advice about the interpretation of percentile ranks. First, changes on the extreme ends of the percentile rank distribution carry more weight than changes toward the middle. For example, the difference between a percentile rank of 50 and 55 is less meaningful than the difference between 5 and 10, between 30 and 35, or between 90 and 95. Also, percentile ranks are not to be averaged or summed. Percentile rank, an index of individual standing among a group, should not be confused with *percentage*, an index of proportion of a total group.

II. A Tool for the Calculation of Percentile Ranks

A tool for the calculation of percentile ranks has been developed for use with Maintenance Resource Management training evaluation in aviation. The following section describes a tool that allows trainers on-site to enter data and get percentile ranks on five survey scales. The tool is designed to readily provide benchmarked feedback to MRM trainers using percentile ranks.

An Evaluation Results Calculator for MRM Trainers and Implementers: Including Percentile Rank and Longitudinal Means Comparison

The *MRM Evaluation Results Calculator* introduced here is a tool for organizations to examine themselves in relation to other companies. The tool has been developed specifically for use by Maintenance Resource Management trainers and implementers using the Maintenance Resource Management / Technical Operations Questionnaire (Taylor & Thomas, 2001). This application has implications for almost any instance where data is acquired for a variety of same-industry companies. The aim is to provide a tool for self-evaluation that will assist trainers in tailoring their content and approaches to reach desired learning objectives. Trainers will be immediately able to enter survey data on-site and acquire a picture of where they stand in the industry. Because rapid and consistent feedback is such a critical part of learning and personal improvement, trainers will likely find this self-usable calculator a welcome addition to training improvement pursuits.

How the Evaluation Results Calculator Works

The evaluation results calculator presented here is an MS Excel program. It operates by converting raw survey scores (entered by the user) into z-scores, and calculate the area of a normal curve **below** that z-score. This is accomplished by embedding a Standard Normal Distribution Table (found most introductory statistics textbooks) into the Excel program. The percentile rank calculation is not statistically complex, and does allow a readily available way to achieve useful information with data collected on-site.

In addition to percentile ranks, the calculator also provides pre- and post-training mean scores and calculates a *t-test* to determine statistical significance. Graphs are included in the program output, which automatically update as data are entered. The user needs only to enter the data, and then print the graphs.

Instructions for Using the MRM Evaluation Results Calculator

The MRM/TOQ Evaluation Results Calculator is designed for use with Pre- and Post-versions of the MRM/TOQ. Its operation is summarized in three simple steps: data entry, interpretation of results, and graphs:

Step 1) Data Entry

The MRM/TOQ Evaluation Results Calculator requires data entry into Excel worksheets designated for pre- and post-training data. The questions are listed across the top of each worksheet in the same order they appear on the pre- and post- survey instruments. Illegible or omitted survey responses should simply be skipped during data entry. After all the surveys at hand are entered, results are obtained by clicking on the *Scale Means and Ranks* worksheet. To summarize, data entry for the evaluation results calculator occurs in three steps:

1. Enter Pre-Training Data into *Pre-Training Data Entry* worksheet.
2. Enter Post-Training Data into *Post-Training Data Entry* worksheet.
3. Go to *Scale Means and Ranks* worksheet to view calculated results.

Step 2) Interpretation Of Results

The MRM/TOQ Evaluation Results Calculator yields Pre- and Post- mean scores, as well as Pre- and Post- percentile ranks. These calculations are made for several validated survey scales (Taylor and Thomas, 2001). When Pre- and Post-Training mean scores bear a significant difference at the .05 level, or better, those scores and the respective scale are highlighted in orange.

An important note applies to the use of percentile rank to determine success of a training intervention as applied here. For the purposes of the MRM/TOQ pre-post surveys, an increase in percentile rank from pre-test to post-test does not mean that an actual increase took place by the group being examined. This is because the scores are being calculated against two different distributions (pre and post). Rather, the pre- and post- percentile ranks show group or individual standing against industry measures at separate points in time. If the larger population happened to increase on average at a lower rate from pre to post, then a particular group could show an increase in percentile rank by merely maintaining the same raw mean score or decreasing to a lesser extent.

Step 3) Graphs

Results are graphed at the bottom of the *Scale Means and Ranks* worksheet in two ways: Scale means and scale percentile ranks. Further, scale mean and percentile rank results are separated into pre- and post-training.

Measures used in the Evaluation Results Calculator

The following are measures used in the MRM Evaluation Results Calculator as evidence of training impact.

Scales

The following scales were developed and validated through factor analysis using the MRM/TOQ (see Taylor & Thomas, 2001).

Trust Supervisor's Safety Practices This scale reflects the quality of the relationship between the respondent and her/his supervisors or managers on safety related matters. Survey questions that comprise this scale probe for how much the respondent feels she/he can approach management without fear of punishment, backlash or inaction (especially with safety issues and suggestions).

Value Trust and Communication with Coworkers This scale, also a trust measure, indicates the importance of trust and quality communication among the respondent's coworkers. General importance and feeling of open communication, debriefing and shift meetings are measured by this scale.

Value of Assertiveness A critical component of good communication in aviation maintenance that is stressed in MRM training is the ability to speak and listen assertively when doubt arises or a situation seems unclear. This scale measures the respondent's comfort in disagreeing with or speaking out against the opinions of others in maintenance.

Understand Effects of Stress This scale measures the respondent's awareness of the impact and importance of individual stress factors to her/his performance. The degree to which the respondent believes that fatigue and personal problems degrade safe performance are measured with this scale, as well as self-perceived ability to separate personal problems from work.

Enthusiasm for the Training Post-training enthusiasm measures are taken to assess trainee motivations to transfer training concepts to the work environment. Enthusiasm is measured only for post training, and is comprised of three statements for which respondents are to rate their level of agreement: 1) *This training can increase safety and teamwork*, 2) *This training will be useful to others* and, 3) *This training will change my behavior*.

Summary

The MRM Evaluation Results Calculator contains tools designed for MRM trainers and implementers to quickly and conveniently obtain feedback on the impact of their program. The Calculator shows pre-post change, as well as percentile ranks indicating a respondent groups standing among the industry. These calculations are performed for survey scales and enthusiasm measures from the Maintenance Resource Management / Technical Operations Questionnaire (MRM/TOQ).

References

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