by Joseph T. Martelli

Using Statistics in HRD

FOR MANY HRD professionals, using statistics seems a daunting task—but it needn't be. For some, the fear of statistics conjures a former college course on the subject, and the thought of memorizing all those formulas and performing tedious calculations again can be mindboggling.

This article may help change the way you think about and use statistics. Statistics are not something to be intimidated by or fearful of. In fact, using them can make your job easier. Today, the last thing you should be doing is calculating statistics by hand. Instead, let a PC-based software package do the calculating for you. PC-based statistical packages are abundant, and the prices are affordable.

While you can let your PC do the numbers crunching for you, it is necessary to understand how to interpret and use statistics appropriately; no PC can do that. In order to properly use statistics, there are some important concepts and principles you must understand.

Classification of statistics

Statistics come in two types: descriptive and inferential. As the name implies, descriptive statistics describe data. Three of the most common descriptive statistics are called measures of central tendency: the mean, the median, and the mode. These are what most non-statisticians call the "average" and, as we will see below, each serves a purpose.

Most HRD professionals use descriptive statistics regularly, whether they know it or not. Descriptive statistics are frequently used in conjunction with charts and graphs to display data visually. Charts and graphs are an easy and simple way to visualize trends that have large amounts of data.

The more powerful types of statistics are inferential statistics. Inferential statistics let the user make inferences about a population using a sample drawn from the population. With inferential statistics (and a solid research design), the user can estimate the probability that a relationship observed in the sample is also true for the larger population. With descriptives, you are limited primarily to describing associations within the sample itself.

Classification of data

HRD professionals are constantly collecting data, whether they know it or not. Evaluation sheets from training programs, questionnaires and surveys, training program cost data, program development costs, and needs analysis results, all represent data. Being able to handle or process the data is what discriminates the novice from the seasoned professional.

It's important to understand the levels of data, and to be aware of the level of data for each piece that you work with. For example, a questionnaire, even a short two-pager, may have up to 100 measures, and each data point has its own level.

There are four primary classifications of data.

- Nominal. Nominal data are the simplest types of data we have. Mathematical operations (+, -, x, and /) make no sense for nominal-level data. Nominal-level data, from a statistical perspective, lets us code or classify items into groups. Examples of nominal data are an employee's sex, department, or occupation. Their purpose is merely to classify or identify people or things within a larger system. The mode (the most frequent item) as a measure of central tendency is appropriate for use with nominal-level data.
- Ordinal. Ordinal-level data have all the characteristics of nominal data, but, in addition, these data imply a rank order of importance. Take for instance a performance appraisal that simply rates whether an employee's performance is poor, fair, good, or excellent. With this ordinal measure, you can rank people according to their performance, but you can't tell, for example, the difference between "good" performance and "fair" performance. In addition to the mode, you can calculate the median when using ordinal data. The median is the value that falls in the middle when all the data points are ranked.
- Interval. Interval-level data are even more powerful than ordinal and nominal data because the differences between values can be meaningfully interpreted. An excellent example is IQ. We know that the difference between an IQ of 95 and 100 is exactly the same as the difference between 100 and 105. The Celsius temperature scale is another good example.

With these data, you also can calculate the mode, median, and mean—the average of all the responses. Because you can calculate the mean, you can also calculate the standard deviation, a measure of how much variation you have in the data.

- Ratio. Ratio-level data have all the characteristics of interval-level data, plus a true zero point. The ratio measure is the most analytically versatile because the responses have a starting

KEY TERMS

correlation coefficient. a measure of the strength of a relationship between two items.
interval data. data that can be rank-ordered *and* have equal distances between adjacent values.
mean. the arithmetic average of a set of data.
median. the middle value in a rank-ordered set of data.
mode. the most frequently observed value in a set of data.
nominal data. data that only identifies or classifies items into groups.
null hypothesis. a statement that asserts that there is no relationship between two measures.
ordinal data. data that can be rank-ordered.
population. the whole group of people or things of interest.
ratio data. data that can be rank-ordered with equal distances between adjacent values and a zero-point with a clear meaning.
sample. a small number of cases drawn from the population.
standard deviation. a measure of how widely a set of data varies from its average value.

point (zero) with a clear meaning. Take, for instance, income. If one person's income is $25,000 and another person's is $50,000, we can say that the second person's income is twice as much as the first. This is not something you can do with lower levels of data. We know that $0 means no salary; we can't say that 0° degrees Celsius means no temperature because it's the same temperature as 32° Fahrenheit.

Unfortunately in the HRD field, much of the data we work with are typically at the nominal- or ordinal-level of measurement. Because of the limitations of working with these levels of data, such as fewer statistics, people sometimes treat them as interval- or ratio-level data. Although this is possible, it must be done with integrity, full awareness that it's being done, and knowledge of its limitations.

Determining relationships among variables

To test for a clear cause and effect connection among variables, one must have a highly controlled experimental environment. As the degree of control is lost, or when one tries to work with existing data, she or he may have to settle for a relational study. In that kind of study, relationships, but not cause and effect connections, can be inferred.

The strength of the relationship between two events is measured by a statistic called a correlation coefficient. A correlation is always expressed as a number between +1.00 and -1.00. A 1.00 represents a perfect relationship. A +1.00 indicates a perfect positive relationship—that is, if you measure high on one variable, you also measure high on the other. Education and income, for example, are usually related. People with more education tend to be higher paid.

A -1.00 indicates a perfect negative relationship—if you are high on one variable, you are low on the other. In other words, a negative relationship shows an inverse relationship between two variables. For example, scrap error rates may be lower for operators with more training. The complete absence of a relationship is indicated by a correlation of 0.00. To determine if a correlation is strong enough to be real, you could look it up in a table of 'r' values found in most statistics textbooks. However, most software packages will provide this information for you.

Hypothesis testing and inferential statistics

When using an inferential statistic to test for the presence or the absence of a relationship between two measures or items, you test a "null" hypothesis. The null hypothesis states that you expect no relationship (i.e., that the inferential statistic should equal zero). The null hypothesis helps keep you objective and unbiased by forcing you to prove a relationship exists. Thus, if the inferential statistic turns out to be significantly different from zero, you "reject the null hypothesis," and can state with a high level of certainty that the observed relationship exists.

As an illustration, when evaluating a training class, you would hypothesize that the test scores of a group of untrained employees and a group of trained employees are the same. Testing and rejecting this null hypothesis would allow you to infer a relationship between training and test scores.

The essential task of using statistics for HRD moves from manipulating complex and time-consuming formulas to being able to choose the right statistic for the job (data) and understanding what it tells you, while the computer effortlessly and efficiently does the legwork.

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