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Demo: Conducting a Gauge R&R Analysis

In this video, we use the file Micrometer.jmp to demonstrate how to conduct a Gauge R&R analysis in JMP.

In this study, the measurement system of interest is a hand micrometer, and the quality characteristic is the diameter of metal bearings. The study involves three inspectors measuring 10 parts, with each inspector measuring each part twice.

Let's select the Measurement Systems Analysis platform from the Analyze menu under Quality and Process.

We select Diameter as Y, Response, Part as Part, Sample ID and Inspector as X, Grouping, and under MSA Method, we select Gauge R&R.

The Model type is Crossed, because every inspector measures every part. Several analysis settings are available. We select Use REML analysis as the method for estimating the variance components and click OK. If you select a different analysis setting, your results might be slightly different. For more information on the available methods for estimating variance components, search for Variance Components in the JMP Help.

Finally, we click OK to run the analysis.

The Variability chart for Diameter shows the repeated measurements for each part measured by each inspector.

To conduct a Gauge R&R analysis, we select Gauge Studies from the top red triangle and then Gauge R&R.

The K, Sigma Multiplier is 6. This defines the process width as 6 standard deviations.

You can either enter spec limits or the tolerance interval, which is the width of the spec limits. We enter the tolerance interval of 3 cm.

Two tables of output are provided: Gauge R&R and Variance Components.

The Variance Components table summarizes the variance for each source of variation.

The Gauge R&R table summarizes the sources of variation relative to the tolerance interval - the width of the specs. For each source of variation, 6 times the estimate of the standard deviation is reported under the Variation (6*StdDev) column. This result is then compared to the tolerance interval.

Take, for example, repeatability. The potential width of the measurements due to repeatability variation is 1.23 cm. The spec limits are 3 cm wide. The variability due to repeatability is 1.23 divided by 3.0, or 41% of the width of the spec limits.

The total Gauge R&R variation, which includes all sources of measurement variation, is 1.34 cm wide. This is 44.53% as wide as the spec limits.

This value is also reported as the precision to tolerance (or P/T) ratio, where precision is the total Gauge R&R variation and the tolerance is the width of the specs. Our P/T ratio is 44.53.

A measurement system with a P/T ratio of less than 10% is generally considered good. A measurement system that has a P/T ratio between 10 and 30% might be considered acceptable, depending on factors such as how critical the measurement is and how much it would cost to improve

the system. A measurement system with a P/T ratio greater than 30% is generally considered to be in need of improvement.

When we compare the measurement variation to our specifications, we can clearly see that our measurement system is in need of improvement.

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