

# Measurement Systems Analysis

GoSkills online course syllabus

Saturday, February 15, 2025

**Skill level**

Intermediate

**Lessons**

14

**Accredited by**

CPD

**Pre-requisites**

None

**Video duration**

1h 16m

**Estimated study time**

7h 30m for all materials

**Instructor**

Ray Sheen

## Measurement Systems

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### Data Measurement

Data is used throughout business to make decisions concerning business operations and business improvement. To have confidence in the data, the data measurement system must be effective and appropriate for the application. This lesson introduces the concept of a data measurement system and data measurement error.

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### Measurement Systems

A data measurement system is critical for Lean Six Sigma and other improvement projects. The attributes of a measurement system are discussed in this lesson and categories of measurement error are introduced.

3

### Precision and Accuracy

Two of the most important attributes of a measurement system are accuracy and precision. These concepts are explained in this lesson and a simple example is used to illustrate the difference. Also included is a brief discussion on the sources of accuracy and precision errors.

4

### Stability, Linearity, Discrimination

These three attributes of a measurement system are inherent in the design and management of the system. When not managed well they will prevent effective measurements. Each of these is discussed and principles for managing them are introduced.

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### Standards and Calibration

An important aspect of establishing the fidelity of a measurement system and maintaining that fidelity is the use of standards to calibrate the system. This lesson explains the use of standards and the calibration process. It finishes with a recap of the approach to be used with each of the measurement systems errors that have been introduced.

## Gage Repeatability and Reproducibility (Gage R&R)

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### Gage R&R Principles

Gage R&R studies are the best practice for determining measurement system process capability and maintaining that capability. They quantify the level of precision that the measurement system will deliver. Key principles for conducting effective Gage R&R studies are introduced in this lesson including those for managing the appraisers and for selecting the items for measurement.

## 7 Gage R&R Methodology

This lesson describes a step by step process for planning and conducting a Gage R&R Study. It includes templates for data collection for both variable data studies and attribute data studies.

## 8 Gage R&R Study Design Considerations

When designing the study, there are several critical considerations based upon the type of test (destructive or non-destructive), the discrimination of the test system, and whether attribute tests can designate an item into multiple categories beyond Pass/Fail. These considerations impact the accuracy and performance of the analysis.

## 9 Gage R&R Execution and Analysis

This lesson reviews best practices for executing the Gage R&R Study plan. It also explains how the results are presented for both variable data Gage R&R studies and attribute data Gage R&R studies. This includes presenting the target values of acceptable measurement system performance.

## 10 Variable Data Gage R&R Calculations

Variable data Gage R&R Studies calculate a comprehensive measurement that can be used to determine the efficacy of the measurement system that is creating variable measurements of product or process characteristics. This lesson describes those calculations and highlights where weaknesses in the system will be exposed.

## 11 Variable Data Gage R&R Examples

This lesson walks through an example of a variable data Gage R&R analysis. The example is demonstrated using manual data collection and equations with a spreadsheet in Microsoft Excel. The same example is then demonstrated using the statistical software program Minitab, which is often used to conduct analyses for Lean Six Sigma projects.

## 12 Attribute Data Gage R&R Calculations

Attribute data Gage R&R Studies generate a number of metrics that are used for judging the performance of the measurement system used to evaluate pass/fail attribute data. In this lesson, each of these metrics is described and the method of calculation is explained.

## 13 Attribute Data Gage R&R Examples

This lesson walks through an example of an attribute data Gage R&R analysis. The example is demonstrated using manual data collection and equations with the Microsoft Excel spreadsheet application. The same example is then demonstrated using the statistical software program Minitab, which is often used for analyses with Lean Six Sigma projects.

## 14 Type 1 Gage Studies

Gage R&R studies can be done with automated test equipment to be certain that they are providing accurate and precise results. These are known as Type 1 Gage studies. These studies can be used with any type of automated checking or testing system, not just manufacturing systems. A satisfactory Type 1 Study is often needed to convince stakeholders to have confidence in automation.