

Frequency Polygons and Histograms

**Data Science for Quality Management:
Describing Data Graphically**

with **Wendy Martin**

Learning objectives:

Create a Frequency Polygon using RStudio
Create a histogram using RStudio

Frequency Polygons and Histograms

Useful for:

- Evaluating a manufacturing or business process
- Determining machine and process capabilities

Frequency Polygons and Histograms

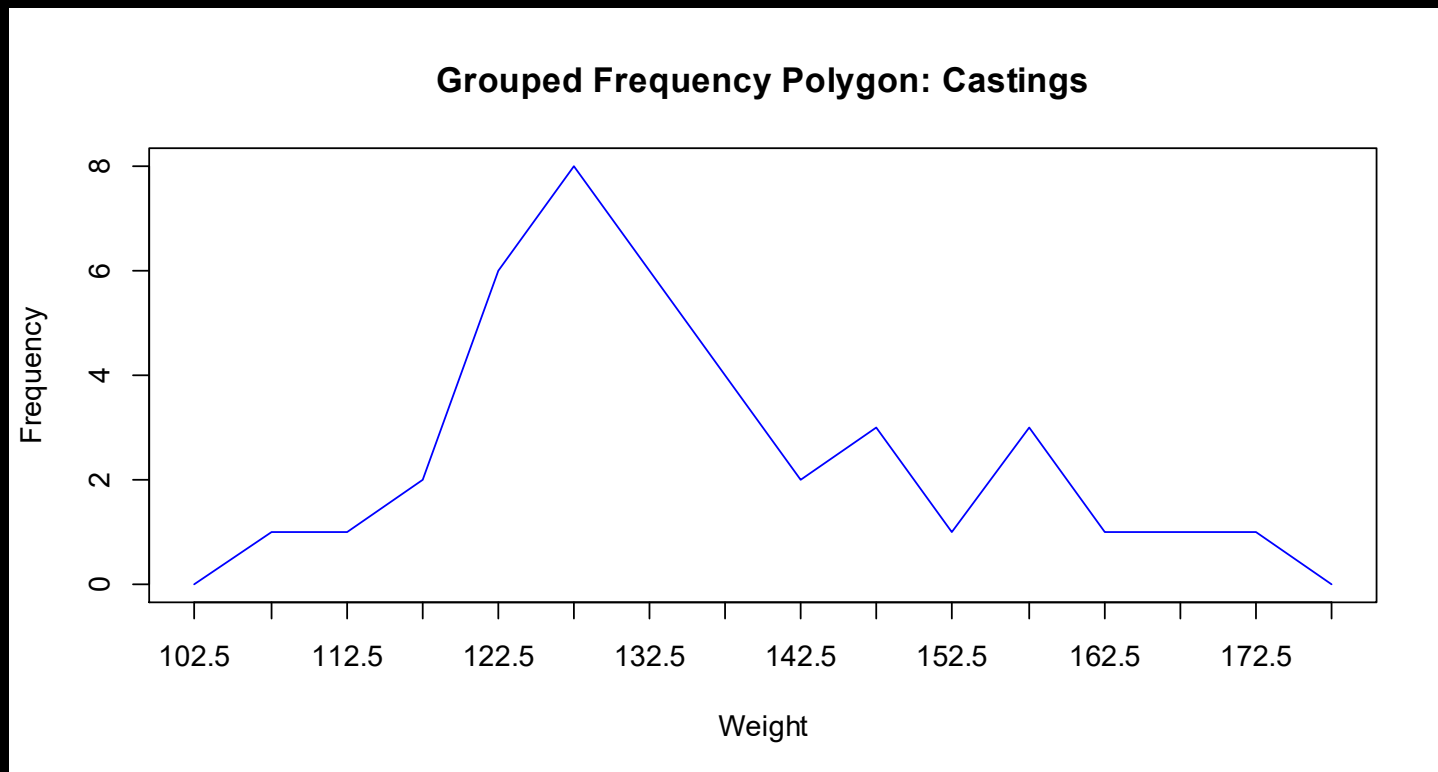
- Comparing material, vendor, operator, process and product characteristics

Ungrouped vs Grouped Frequency Histograms/Polygons

Use ungrouped when there are fewer than 20 unique data values in the data set

Use grouped when there are more than 20 unique data values in the data set

Frequency Polygons



Frequency Polygons

A graph or chart which represents the frequency of observations at each class interval (grouped) or value/score (ungrouped).

Similar to the frequency column of the frequency distribution.

Frequency Polygon: Advantages

Frequency polygons often present a more representative illustration of the data pattern when data are measured along a continuous scale.

Frequency Polygon: Advantages

The polygon becomes increasingly smooth and curve-like as the number of class intervals and sample size (n) increases, more closely representing the sampled population.

Ungrouped Frequency Polygon

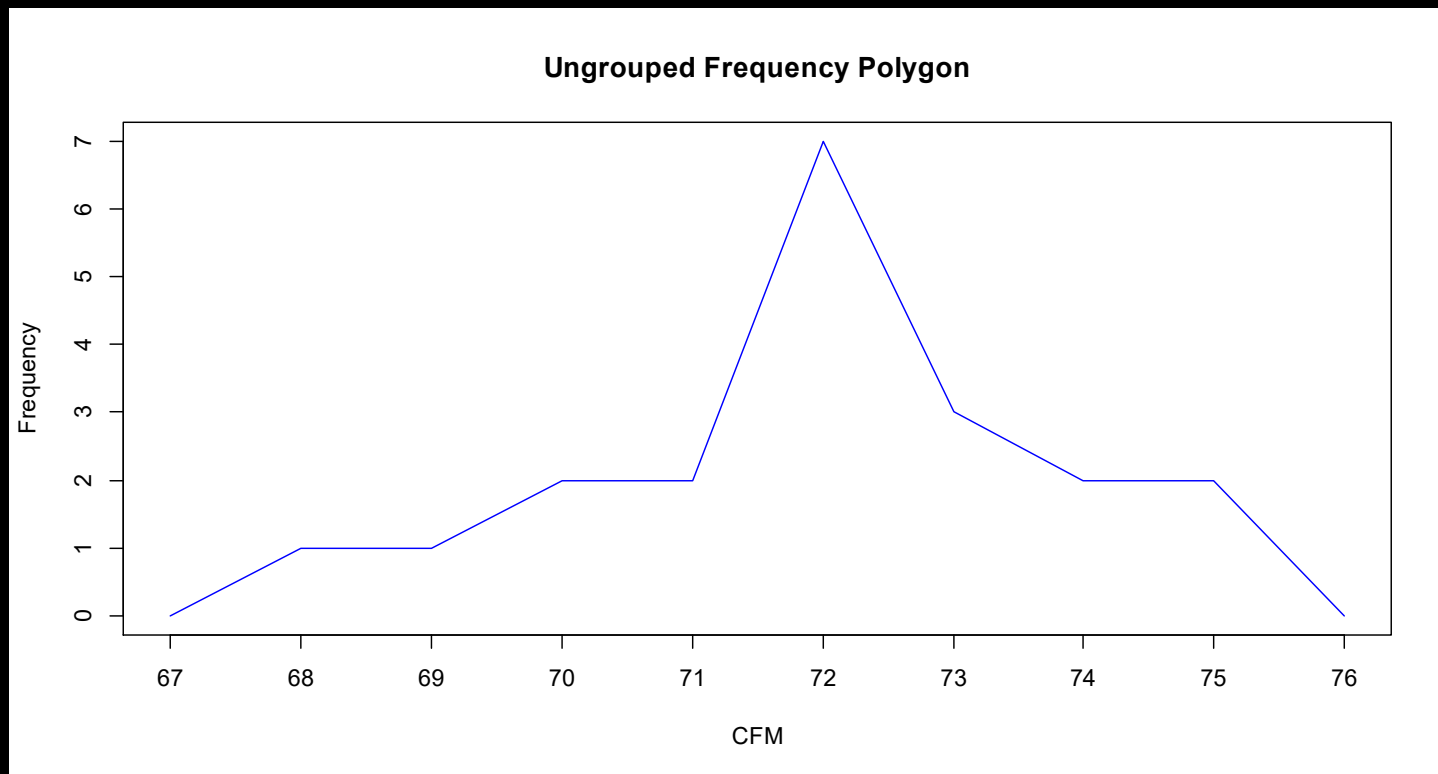
Using the same fan data as we employed for the ungrouped frequency distribution:

Fans 1-10:	68	72	72	74	72	69	75	75	72	73
Fans 10-20:	70	71	71	72	73	72	70	72	73	74

Ungrouped Frequency Polygon in R

```
> frequency.polygon.ungrouped(fans$cfm)
```

Ungrouped Frequency Polygon



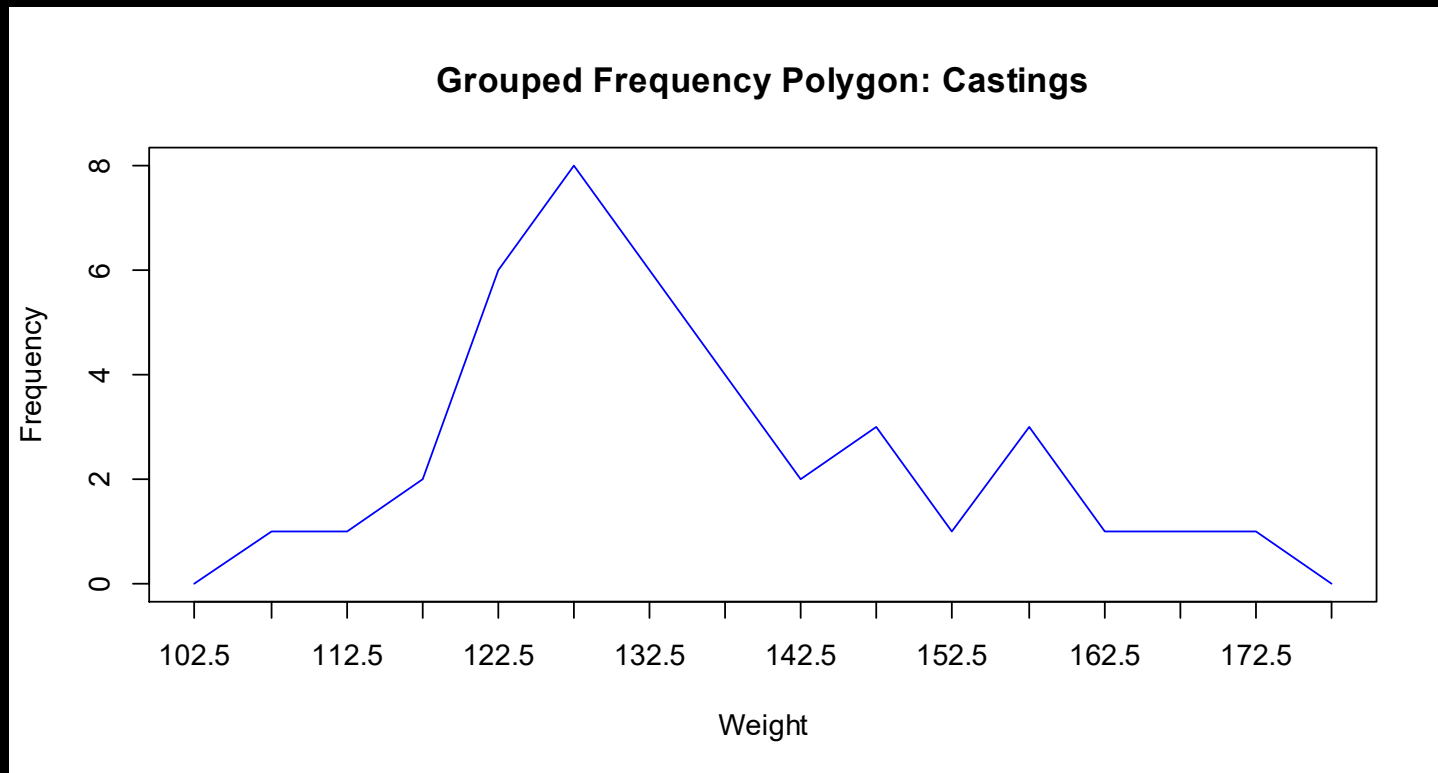
Grouped Frequency Polygon

Using the same castings data as we employed for the grouped frequency distribution:

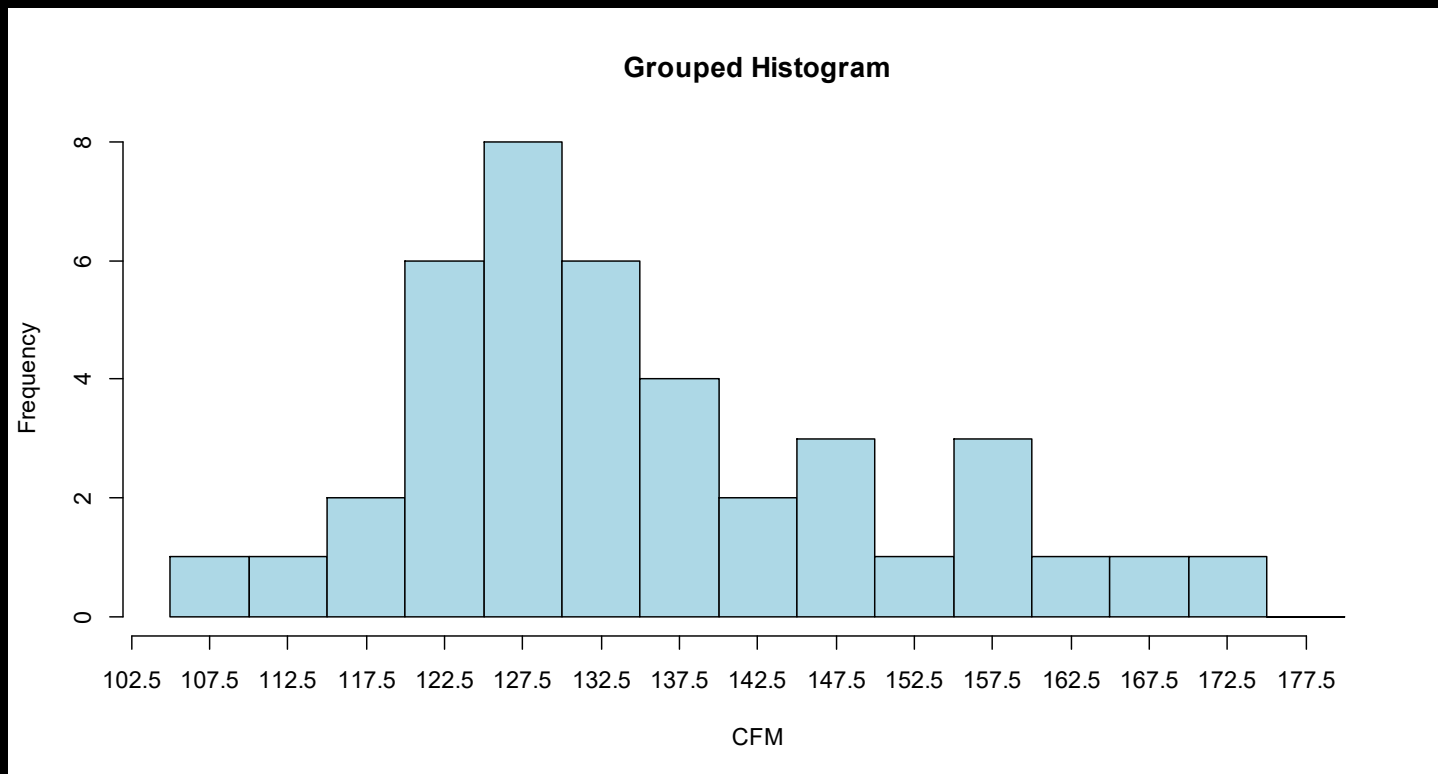
Grouped Frequency Polygon in R

```
> frequency.polygon.grouped(castings$weight)
```

Grouped Frequency Polygon



Histograms



Histograms

Similar to the frequency polygon, except that bars are used to represent the frequency of occurrence at each score or class interval.

Typically, each vertical bar in the histogram is centered above each class interval (or individual score).

Histogram: Advantages

Each bar or rectangular area clearly shows the relative magnitude of that class interval.

The area in each bar reflects the true proportion of the total number of observations occurring in the class interval.

A Note About Histograms

When the data represent **discrete** values, such as counts, histograms must be used.

When the data represent **continuous** values, a frequency polygon or histogram may be used.

Ungrouped Histogram

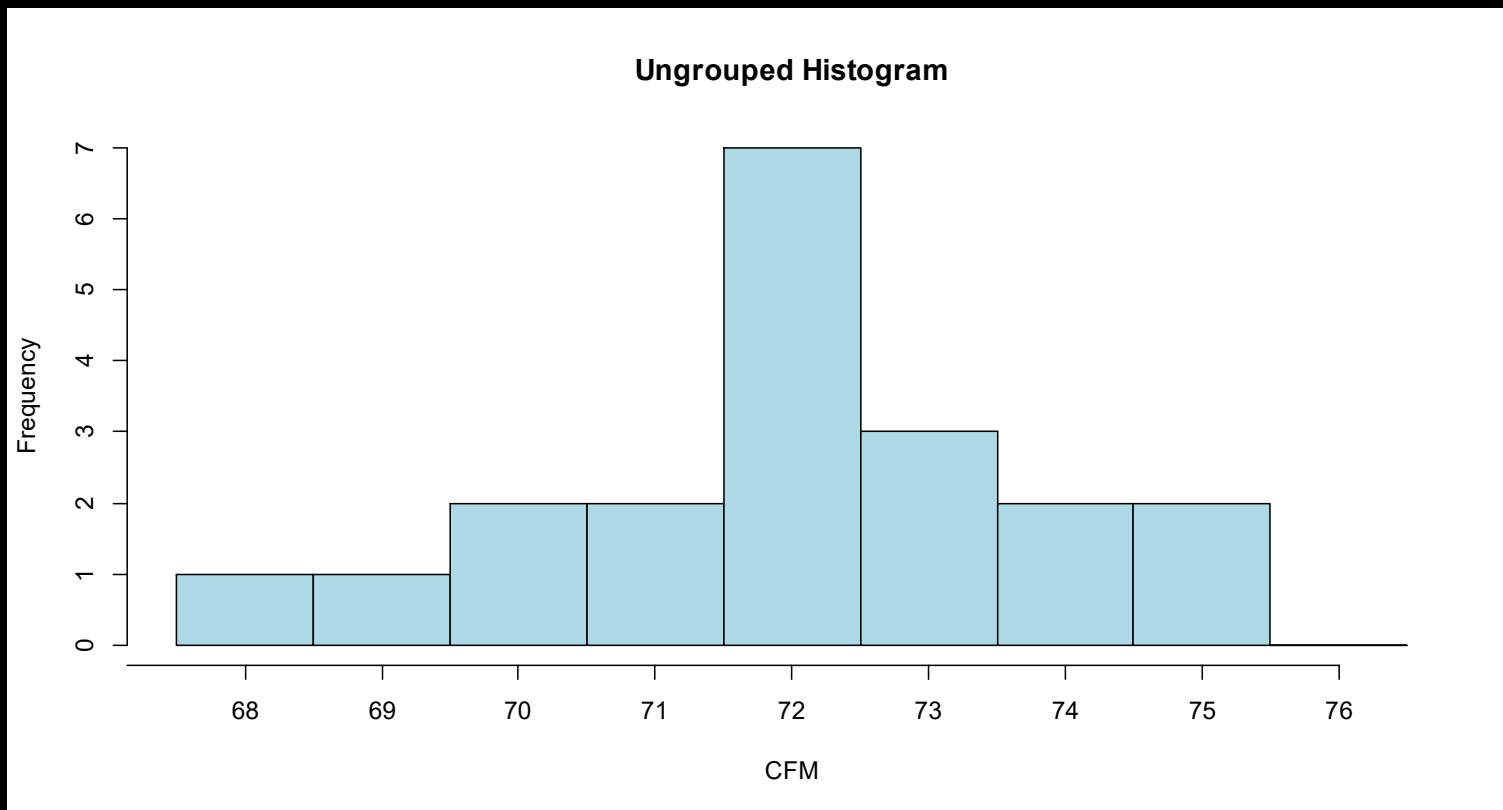
Using the same fan data as we employed for the ungrouped frequency polygon:

Fans 1-10:	68	72	72	74	72	69	75	75	72	73
Fans 10-20:	70	71	71	72	73	72	70	72	73	74

Ungrouped Histogram in R

```
> hist.ungrouped(fans$cfm)
```

Ungrouped Histogram



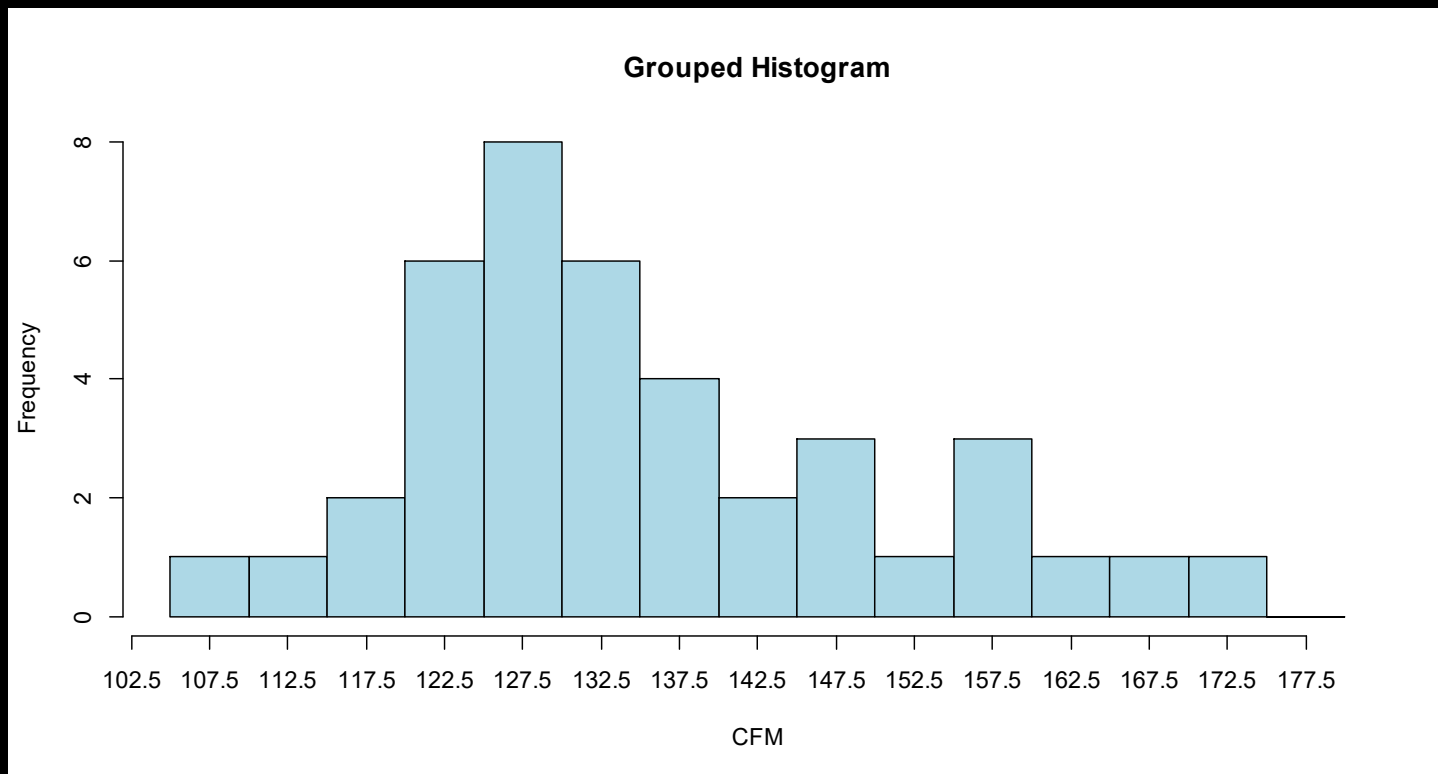
Grouped Histogram

Using the same castings data as we employed for the grouped frequency polygon:

Grouped Histogram in R

```
> hist.grouped(castings$weight)
```


Grouped Histogram



Sources

The material used in the PowerPoint presentations associated with this course was drawn from a number of sources. Specifically, much of the content included was adopted or adapted from the following previously-published material:

- Luftig, J. An Introduction to Statistical Process Control & Capability. Luftig & Associates, Inc. Farmington Hills, MI, 1982
- Luftig, J. Advanced Statistical Process Control & Capability. Luftig & Associates, Inc. Farmington Hills, MI, 1984.
- Luftig, J. A Quality Improvement Strategy for Critical Product and Process Characteristics. Luftig & Associates, Inc. Farmington Hills, MI, 1991
- Luftig, J. Guidelines for Reporting the Capability of Critical Product Characteristics. Anheuser-Busch Companies, St. Louis, MO. 1994
- Spooner-Jordan, V. Understanding Variation. Luftig & Warren International, Southfield, MI 1996
- Luftig, J. and Petrovich, M. Quality with Confidence in Manufacturing. SPSS, Inc. Chicago, IL 1997
- Littlejohn, R., Ouellette, S., & Petrovich, M. Black Belt Business Improvement Specialist Training, Luftig & Warren International, 2000
- Ouellette, S. Six Sigma Champion Training, ROI Alliance, LLC & Luftig & Warren, International, Southfield, MI 2005