EXCELSIOR COLLEGE

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CENTER FOR PROFESSIONAL DEVELOPMENT

SIX SIGMA BLACK BELT

200 Hours/12 Months/Instructor-Facilitated
Course Code: **CPD118**

OVERVIEW

The Six Sigma Black Belt Online Training Program integrates Six Sigma with hands-on data analysis. The program material provides you with an in-depth look at the Six Sigma Black Belt problem-solving methodology, DMAIC: Define the problem, Measure key aspects, Analyze data, Improve the process, Control the future process. You'll also learn about deployment and project development approaches. Since software will be used for data analysis, the material concentrates on the application and use of the tools, rather than on detailed derivation of the statistical methods.

Your analytical and problem-solving skills will be challenged by workshops, which are incorporated extensively throughout the training. Once you've successfully completed the program, you'll be eligible to work toward a Black Belt Certification through the International Quality Federation (http://www.iqfnet.org). Achieving this certification is at your discretion and dependent upon you meeting the criteria the International Quality Federation sets; certification is not automatic upon completion of this program or tied to the accredited college or university you registered through.

OBJECTIVES

Upon completion of this program, you'll be able to:

- Participate in the development of a successful Six Sigma program
- Contribute to the definition of project selection criteria and develop project proposals to meet those criteria
- Lead a Six Sigma project team using the DMAIC problem-solving methodology and team-building skills
- Apply and interpret basic and advanced Six Sigma tools, as necessary, for project definition, process baseline analysis, process improvement, and process control

MATERIALS INCLUDED

- *Six Sigma Demystified* by Paul Keller
- *Six Sigma Handbook* by Thomas Pyzdek and Paul Keller
- Black Belt Notebook
- Green Belt XL software including MindGenius
- IQF Study Guide
- IQF Certification Exam

OUTLINE

1. Why Do Six Sigma
    a. Definition and Graphical View of Six Sigma
        i. Overview of Business Applications
        ii. Example Sigma Levels
        iii. Introduction to DPMO and Cost as Metrics
    b. Comparisons Between Typical TQM and Six Sigma Programs
    c. Origins and Success Stories

2. How to Deploy Six Sigma
    a. Leadership Responsibilities
    b. Description of the Roles and Responsibilities
    c. Resource Allocation
    d. Data-driven Decision Making
    e. Organizational Metrics and Dashboards

3. Six Sigma Projects
    a. Project Focus
    b. Selecting Projects
    c. Overview of DMAIC Methodology
    d. Project Reporting

4. Incorporating Voice of the Customer
    a. Goal Posts vs. Kano
    b. Customer Focus and the Leadership Role
    c. Overview of QFD
    d. Customer Data
    e. Big Y's, Little Y's

5. DEFINE: Project Definition
    a. Tasks
    b. Work Breakdown Structure
    c. Pareto Diagrams
    d. Process Maps
    e. Matrix Diagrams
    f. Project Charters
    g. Reporting

6. DEFINE: Project Financials
    a. Quality Cost Classifications
    b. Quantifying Project Benefits
    c. Calculations

7. DEFINE: Goals and Metrics
    a. CTC, CTQ, CTS Parameters
    b. CTx Flow-down Model (Big Y's, Little Y's)
    c. Measurement & Feedback
    d. Calculating Sigma Levels

8. DEFINE: Project Scheduling
    a. Activity Network Diagram

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b. PERT Analysis
c. GANNT Chart

9. DEFINE: Change Management/Teams
    a. Problems With Change
    b. Achieving Buy-in
    c. Team Formation, Rules, and Responsibilities
        i. Stages of Team Development
        ii. Overcoming Problems
    d. Consensus Building
        i. Affinity Diagram
        ii. Nominal Group Technique
        iii. Prioritization Matrix

10. MEASURE: Tools
    a. Measure Stage Objectives
    b. Flowcharts
    c. Process Maps
    d. SIPOC
    e. Box-Whisker Plots
    f. Cause and Effect Diagrams
    g. Check Sheets
    h. Interrelationship Digraph
    i. Stem and Leaf Plots

11. MEASURE: Establishing Process Baseline
    a. Enumerative vs. Analytic Statistics
    b. Process Variation
        i. Deming's Red Bead
    c. Benefits of Control Charts
    d. Requirements vs. Control
        i. Tampering
    e. Control Chart Interpretation
        i. Relative to Process Baseline Estimates

12. MEASURE: X-Bar Charts
    a. Uses
    b. Construction and Calculations
    c. Assumptions
    d. Rational Subgroups
    e. Sampling Considerations
    f. Interpretation
        i. Run Test Rules

13. MEASURE: Individuals Data
    a. Uses
    b. Construction and Calculations
    c. Assumptions
    d. Sampling Considerations
    e. Interpretation
    f. Overview of Other Individuals Charts

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        i. Run Charts
        ii. Moving Average Charts
        iii. EWMA Charts

14. MEASURE: Process Capability
    a. Histograms
    b. Probability Plots
    c. Goodness of Fit Tests
    d. Capability and Performance Indices
        i. Relative to Process Control
        ii. Interpretation
        iii. Estimating Error

15. MEASURE: Attribute Charts
    a. Uses
    b. Selection
    c. Construction and Calculations
    d. Sampling Considerations

16. MEASURE: Short Run SPC
    a. Uses
    b. Calculations
        i. Nominals Chart
        ii. Stabilized Chart

17. MEASURE: Measurement Systems Analysis
    a. Stability Studies
    b. Linearity Analysis
    c. R&R Analysis
        i. Range Method Calculations
        ii. Interpretation
        iii. Using Control Charts
        iv. Destructive Tests
        v. ANOVA Method

18. ANALYZE: Lean Thinking
    a. Definition of Waste
    b. Analyzing Process for NVA
        i. Cycle Efficiencies
        ii. Lead Time and Velocity
        iii. Methods to Increase Velocity
            1. Standardization
            2. Optimization
            3. Spaghetti Diagrams
            4. 5S
            5. Level Loading
            6. Flow
            7. Setup Reductions
    c. ANALYZE: Sources of Variation
        i. Multi-vari Plots
        ii. Confidence Intervals on Mean

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iii. Confidence Intervals on Percent
iv. Hypothesis Test on Mean
v. Hypothesis Test on Mean of Two Samples
vi. Power and Sample Size
vii. Contingency Tables
viii. Non-parametric Tests

d. ANALYZE: Regression Analysis
   i. Scatter Diagrams
   ii. Linear Model
   iii. Interpreting the ANOVA Table
   iv. Confidence and Prediction Limits
   v. Residuals Analysis
   vi. Overview of Multiple Regression Tools
      1. DOE vs. Traditional Experiments and Data Mining

e. ANALYZE: Multiple Regression
   i. Multivariate Models
   ii. Interaction Plots
   iii. Interpreting ANOVA Tables
   iv. Model Considerations
   v. Stepwise Regression
   vi. Residuals Analysis

f. ANALYZE: DOE Introduction
   i. Terminology
   ii. DOE vs. Traditional Experiments
   iii. DOE vs. Historical Data
   iv. Design Planning
   v. Design Specification
      1. Selecting Responses
      2. Selecting Factors and Levels
   vi. Complete Factorials
   vii. Fractional Factorials
      1. Aliasing
      2. Screening Designs

g. ANALYZE: DOE Analysis Fundamentals
   i. Estimating Effects and Coefficients
   ii. Significance Plots
   iii. Estimating Error
   iv. Extending Designs
   v. Power of Design
   vi. Lack of Fit
   vii. Tests for Surface Curvature

h. ANALYZE: Design Selection
   i. Desirable Designs
   ii. Performance
      1. Balance
      2. Orthogonality
      3. Resolution
   iii. Other Design Models
      1. Saturated Designs
      2. Plackett Burman Designs

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        3. Johns 3/4 Designs
        4. Central Composite Designs
        5. Box Behnken Designs
        6. Taguchi Designs (Mention)

i. ANALYZE: Transforms
    i. Need for Transformations
    ii. Non-constant Variance
    iii. Box-Cox Transforms
    iv. Calculated Parameters
    v. Taguchi Signal to Noise Ratios

j. IMPROVE: Tools
    i. Improve Stage Objectives
    ii. Tools to Prioritize Improvement Opportunities
    iii. Tools to Define New Process Flow
        1. Lean Tools to Reduce NVA and Achieve Flow
    iv. Tools to Define and Mitigate Failure Modes
        1. PDPC
        2. FMECA
        3. Preventing Failures
    v. Reference to Tools for Defining New Process Levels

k. IMPROVE: Response Surface Analysis
    i. Objectives
    ii. Applications
    iii. Sequential Technique
    iv. Steepest Ascent

l. IMPROVE: Ridge Analysis
    i. Graphical Method
    ii. Analytical Method
    iii. Overlaid Contours
    iv. Desirability Function

m. IMPROVE: Simulations
    i. Applications
    ii. Examples
    iii. Applying Probabilistic Estimates

n. IMPROVE: Evolutionary Operation
    i. Methodology
    ii. Example
    iii. Risks and Advantages

o. CONTROL: Tools
    i. Control Stage Objectives
    ii. Control Plans
    iii. Training
    iv. Measuring Improvement

p. CONTROL: Serial Correlation
    i. Applications
    ii. Estimating Autocorrelation
    iii. Interpreting Autocorrelation
    iv. Batch Control Charts

q. Design for Six Sigma Overview
    i. Methodology

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ii. Tools for DFSS
iii. System, Parameter, and Tolerance Designs

COMPUTER REQUIREMENTS

This program is only compatible with Windows XP/Vista/7 and IE 7 and later browsers – it cannot be taken on a Mac. To access this program and study guide, you must have an Internet connection (high-speed recommended). To run the Green Belt XL software, you will need to have Excel 2003, 2007, or 2010. It is recommended that Black Belts have a general statistical software package, such as Minitab. You may purchase an upgrade to the Green Belt XL software that includes a utility to construct designed experiments. Adobe Flash Player and Adobe Acrobat Reader are required and can be downloaded for free at adobe.com.

INSTRUCTOR BIO

Paul Keller, Vice President and COO, is a senior consultant with Quality America, Inc. Paul has developed and implemented successful Six Sigma and quality improvement programs in service and manufacturing environments. Paul has been with Quality America since 1992, where he has:

- Developed and managed systems for overall operations, including quality improvement, product development, partner relations, marketing, sales, order fulfillment, and technical support.
- Provided primary statistical expertise to the customer base, as well as internal software development, sales, and technical support teams.
- Developed and implemented Six Sigma-related courses, including quality management, statistical process control (SPC), and designed experiments, to hundreds of companies in a wide variety of industries, including Roche Pharmaceuticals, Core3 Inc. Business Process Outsourcing, U.S. Army, MacDermid Printing Solutions, Boeing Satellite, Dow Corning, Antec, Pfizer, Warner Lambert, and many others.

Paul has authored a number of well-received publications, including:

- 2009: co-authored third edition of Six Sigma Handbook, New York: McGraw Hill
- 2005: author, Six Sigma Demystified, New York: McGraw Hill (over 35,000 copies sold to date)
- 2003: technical editor, Quality Engineering Handbook, Tucson: QA Publishing, LLC
- 2002: contributing author, Manufacturing Handbook of Best Practices, Boca Raton: St. Lucie Press
- 2001: author, Six Sigma Deployment, Tucson: QA Publishing, LLC
- 2001: co-author, Six Sigma Study Guide, Tucson: QA Publishing, LLC
- 2000: contributing author, Handbook for Quality Technicians and Mechanical Inspectors, Tucson: QA Publishing, LLC
- 2000: contributing author, Handbook for Quality Management, Tucson: QA Publishing, LLC
- 1992-present: numerous articles in professional trade magazines, conference proceedings, and Quality America's Knowledge Center

Before launching Quality America's training and consulting business in 1992, Paul specialized in quality engineering in the Masters program at the University of Arizona. He applied these

techniques as a quality manager for a consumer goods manufacturer (1990-1992) and as an SPC director at an industrial products manufacturer (1987-1990). In these roles, he developed company-wide quality systems to meet the demands of a diverse customer base, including the automotive and aerospace industries.

Paul is currently active in Six Sigma training and consulting through Quality America.

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