

# MWSUG 2008



## Experimental Learning: Use of JMP Journal in Six Sigma Green and Black Belt Training

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# Training and Six Sigma Deployment

- Training is a major component of any Six Sigma Deployment
- Six Sigma training can range from instructor led class room training over a period of four months to self paced web based training
- Training is only a means to an end. Its objective being:
  - Team building, brainstorming and change management
  - Problem solving (Six Sigma: Qualitative and Quantitative)
  - Develop Fluency in the Six Sigma Body of Knowledge
- **Fluency**
  - Is Speed and accuracy in Six Sigma BOK
  - Is Skills, Concepts and Capabilities in the Six Sigma BOK

# Characteristics of Adult Learners

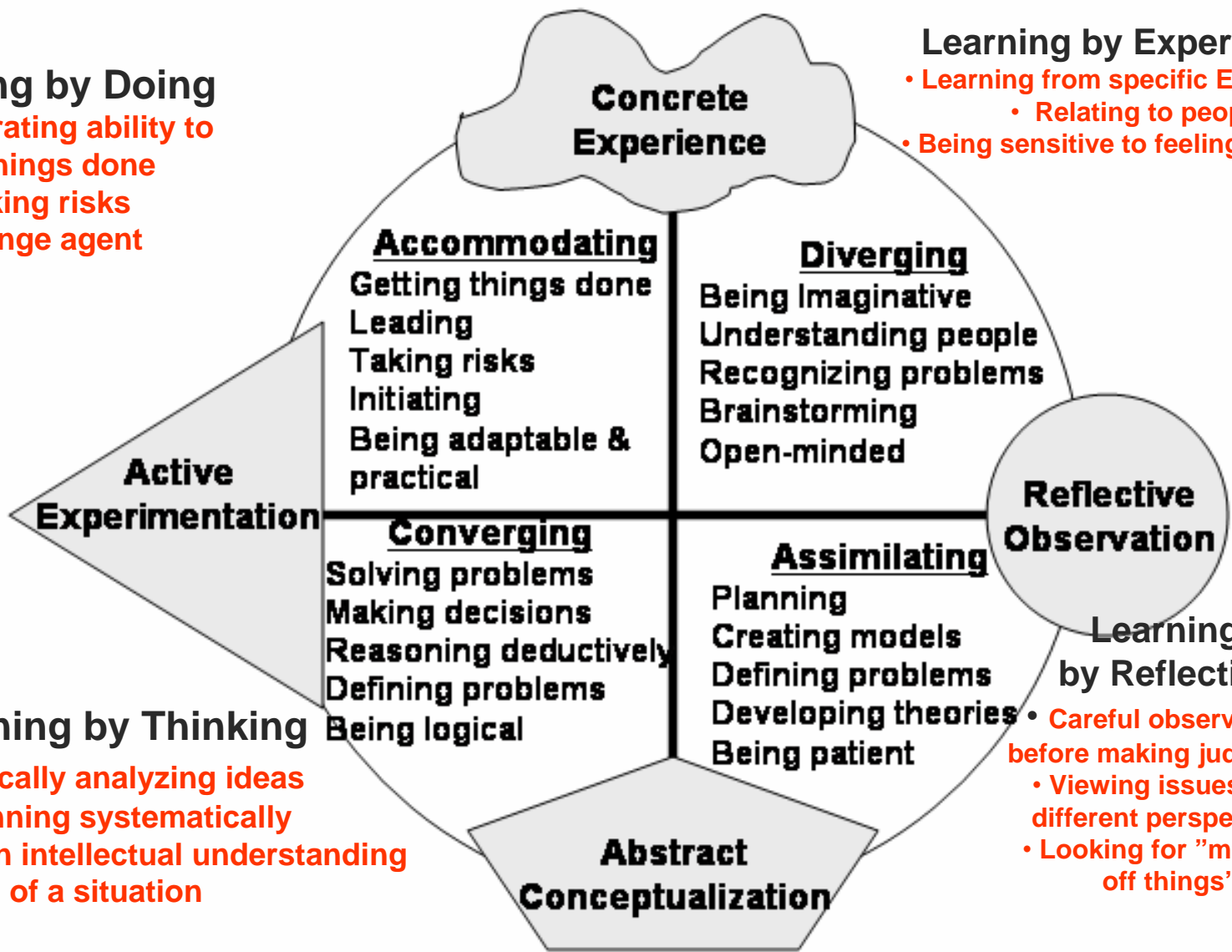
- They are active learners (learn by doing - let us try and see how it works, they like to work in groups and like to discuss and explain to others)
- They bring work related experiences into the training environment
- They have the need to know why there are learning something
- They are self directed (responsible owners and managers of their learning process)
- Dr. Kolb (Case Western Reserve University, OH) proposed a model for adult learning

# Kolb's Experimental Learning Model

**Learning by Doing**  
 Demonstrating ability to get things done  
 Taking risks  
 Change agent

**Learning by Experiencing**

- Learning from specific Experiences
- Relating to people
- Being sensitive to feelings & people



**Learning by Thinking**

- Logically analyzing ideas
- Planning systematically
- Acting on an intellectual understanding of a situation

**Learning by Reflecting**

- Careful observations before making judgments
- Viewing issues from different perspectives
- Looking for "meaning off things"

# Need for a standard “experimental” learning environment during Six Sigma Training

- Trainees have repeatedly pointed out the need for one case study that can be used throughout Six Sigma Training (covering DMAIC phases)
- They would like an environment where they can learn by doing and reflecting on their “hands-on” exercises
- This paper describes the use of experiments involving Alka Seltzer to develop a case study which can be used through most of Six Sigma (DMAIC) training
- The JMP Journal feature provides the ideal platform to foster hands on learning, analysis and reporting (reflective learning)

# Hands on Experiments with the Alka Seltzer system

- Alka Seltzer, water (cold and hot), and coke can be used to illustrate several statistical procedures (data analysis)
  - Described in detail in an SAE (Society of Automotive Engineers) Paper: 2006-01-0794
- Advantages include:
  - Inexpensive and not hazardous (no MSDS sheets needed)
    - No waste disposal issues
  - Can be performed any where in the world (no carry luggage)
  - It is possible to explain results based on fundamental chemical principles
  - Can be laid out in the DMAIC format
- We have used the Alka seltzer system to build a case study work book using the JMP Journal

# Statistical Fluency using Alka Seltzer System and JMP discovery software

- Descriptive statistics
  - Measures of central tendency
  - Testing for process stability, Normality assumption and confidence intervals
  - Process capability
- Hypothesis testing
  - One and two proportion tests
  - One and two sample t-tests (post hoc tests), Paired t-test
  - Test for equal variances
  - One way ANOVA
  - Chi Square test
- Regression
  - Simple linear model
  - Test regression assumptions
  - Multiple linear Regression
- Design of Experiments
  - Fractional, Full and Fold Over designs
  - Response surface designs
  - EVOP
- Destructive Gage R and R (nested ANOVA)

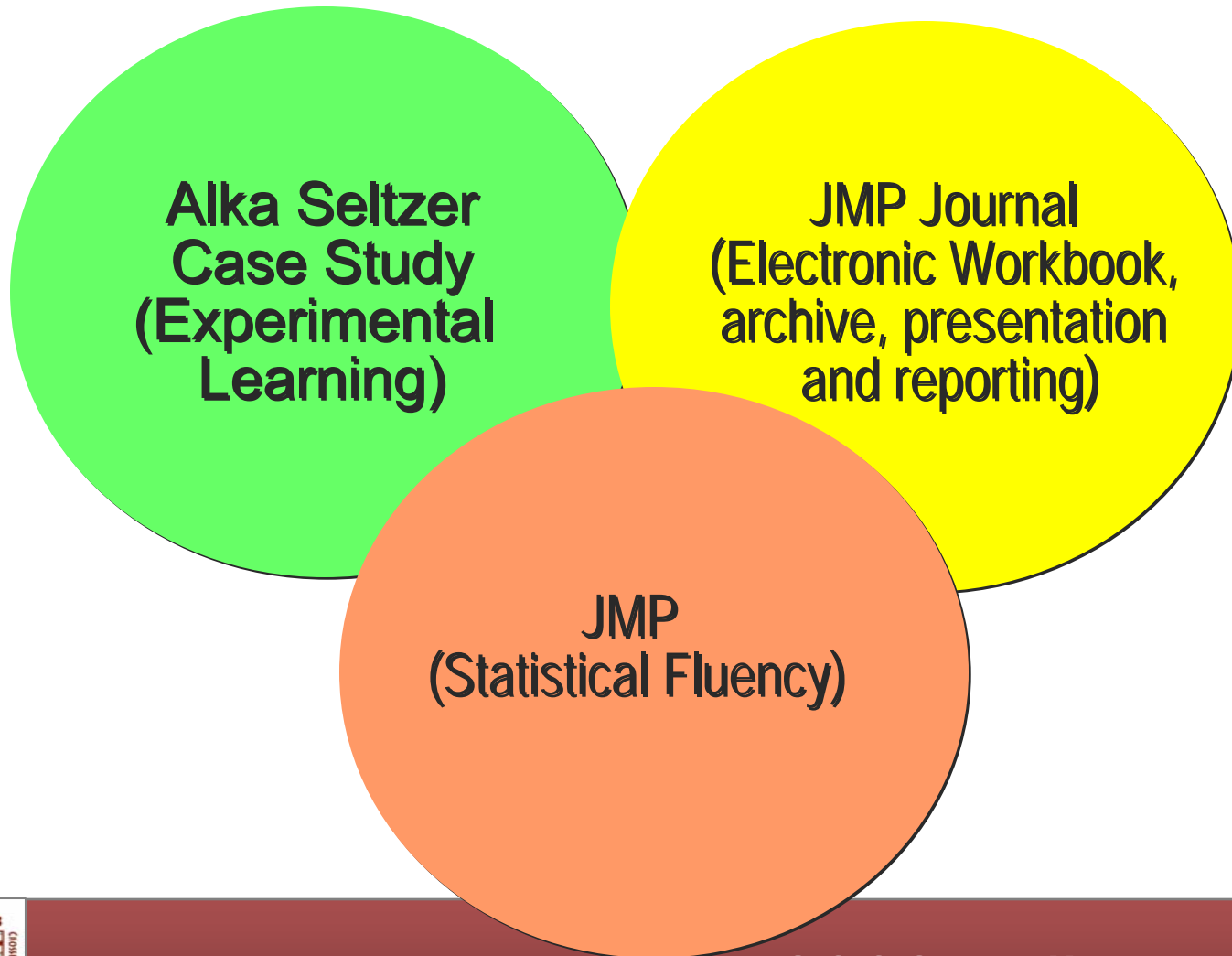
# JMP Journal features: Case study to an electronic laboratory workbook

- The JMP Journal is a method to present various facets of a project, which can include:
  - Incorporate a text item
  - Incorporate an Outline item
  - Incorporate a directory of files
  - Link to a data table
  - Link to a web reference
  - Link to any file HTML file
  - Save JMP scripts
  - Save a Power Point presentation

Illustrate simple features of a JMP Journal



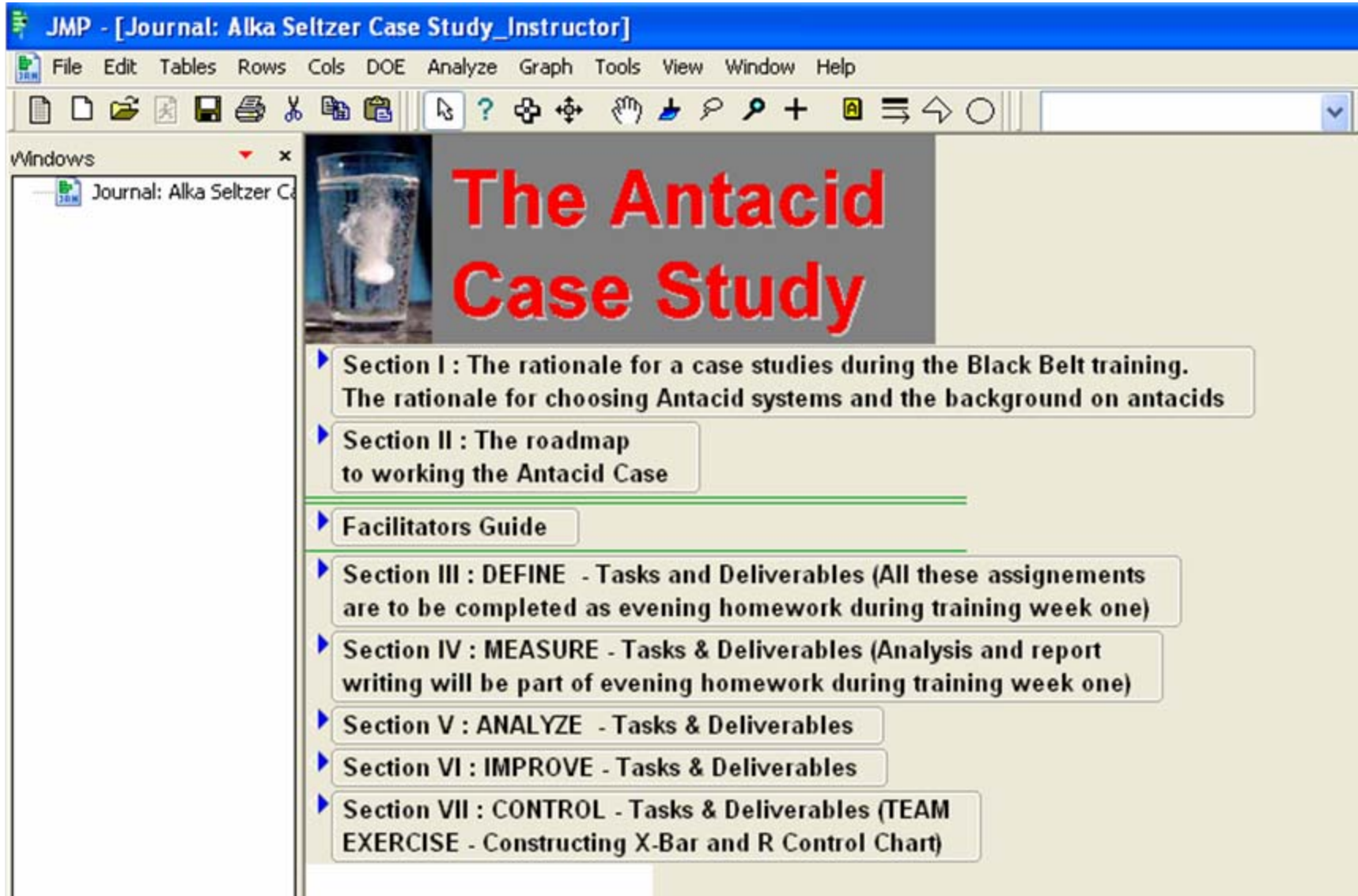
# Integrating Alka Seltzer Case Study and the JMP Journal



# Integrating Alka Seltzer Case Study and the JMP Journal

- We have integrated the Case study (experimental learning) with statistical computational ability of JMP and the documenting and reporting ability of the JMP Journal
  - The case study is presented as a Laboratory workbook (journal)
  - We have made an attempt to use the case study to mirror the DMAIC phases of Six Sigma training
  - We have created a student and an instructor version for the case study
  - We are able to provide all the supporting documentation, references and URL's within the JMP journal
  - We include Power Point presentations where appropriate
  - We have provided practice examples within the work book with solutions run using JMP scripts

# JMP Journal for Alka Seltzer: Instructor Version



**JMP - [Journal: Alka Seltzer Case Study\_Instructor]**

File Edit Tables Rows Cols DOE Analyze Graph Tools View Window Help

Windows

Journal: Alka Seltzer Case Study

## The Antacid Case Study

- ▶ **Section I : The rationale for a case studies during the Black Belt training. The rationale for choosing Antacid systems and the background on antacids**
- ▶ **Section II : The roadmap to working the Antacid Case**
- ▶ **Facilitators Guide**
- ▶ **Section III : DEFINE - Tasks and Deliverables (All these assignments are to be completed as evening homework during training week one)**
- ▶ **Section IV : MEASURE - Tasks & Deliverables (Analysis and report writing will be part of evening homework during training week one)**
- ▶ **Section V : ANALYZE - Tasks & Deliverables**
- ▶ **Section VI : IMPROVE - Tasks & Deliverables**
- ▶ **Section VII : CONTROL - Tasks & Deliverables (TEAM EXERCISE - Constructing X-Bar and R Control Chart)**

# JMP Journal for Alka Seltzer: Instructor Version



## The Antacid Case Study

▶ **Section I : The rationale for a case studies during the Black Belt training.  
The rationale for choosing Antacid systems and the background on antacids**

▼ **Section II : The roadmap to working the Antacid Case**

• *Use Links (to the right) to study this Case*

• "Alka Seltzer and related Antacid Manufacturers seek FDA approval" is the CASE document- Read this first

[Alka Seltzer and related Antacid manufacturers seek FDA approval](#)

• Antacid Growth and World Consumption are JMP Data Files (You will need these JMP data files to answer Parts 3 and 4 listed under Deliverables in the Define Phase

[Antacid Growth](#)

[World Consumption](#)

• "Appendix A\_Required Testing for Antacids" is a document which specifies the various tests that are required in this case

[Appendix A\\_Required Testing for Antacids](#)

• "A report on Antacid testing" is a document was presented at the SAE (Society of Automotive Engineers) congress in April 2006. This document details all the tests covered in the case.

[A report on Antacid testing](#)

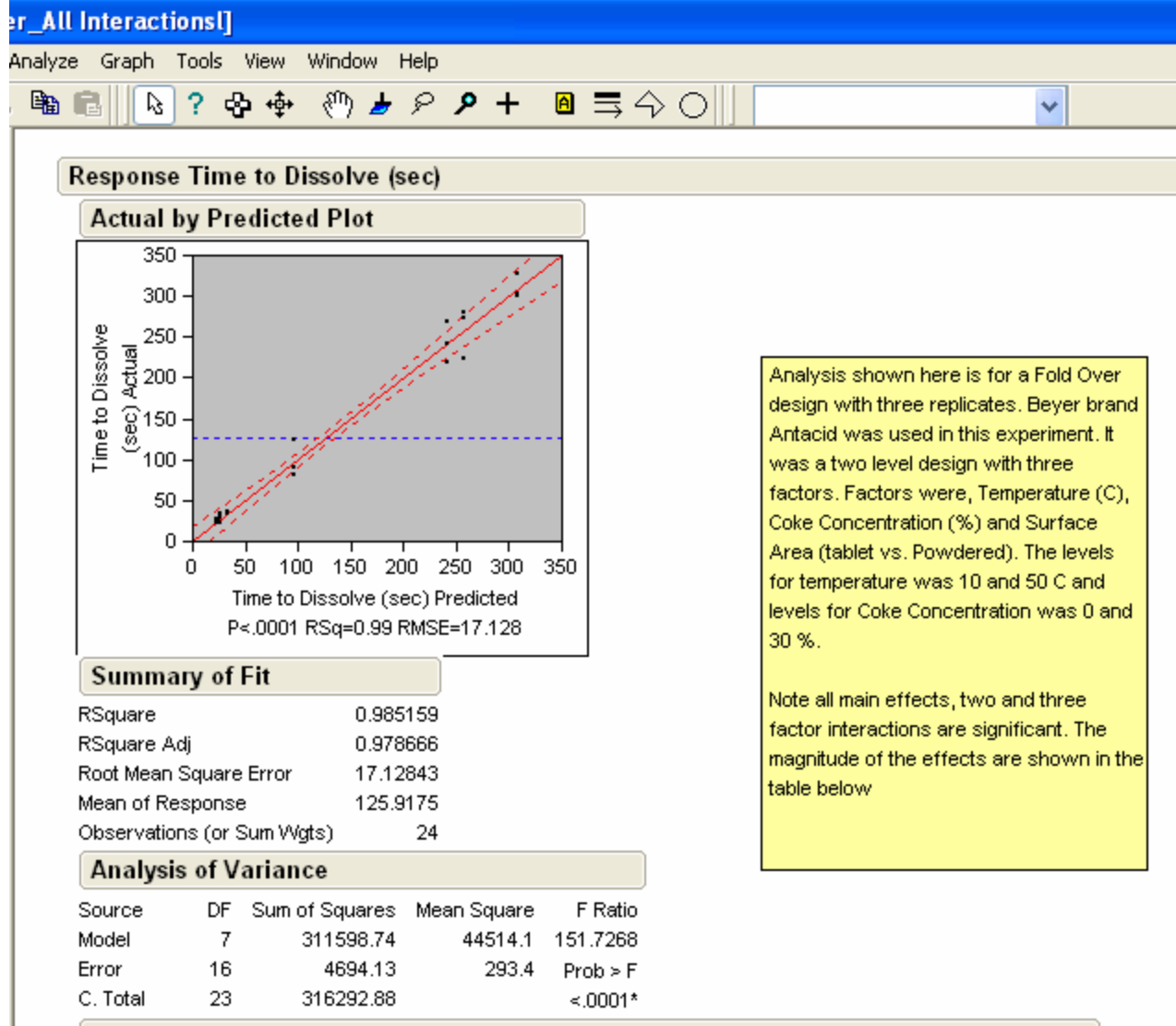
• "Experimenting with Antacids\_Things to consider" is a document which is designed to get you oriented towards Antacid testing. This is a very important document that you need to keep as a reference (this document

[Experimenting with Antacids\\_Things to Consider](#)

• "Expectations for Statistical Testing" is an overview document which outlines the needs for common Statistical tests (You may want to consult this document before proceeding with Statistical Analysis)

[Expectations for Statistical Testing](#)

# JMP Journal for Alka Seltzer: Instructor Version



Analysis shown here is for a Fold Over design with three replicates. Beyer brand Antacid was used in this experiment. It was a two level design with three factors. Factors were, Temperature (C), Coke Concentration (%) and Surface Area (tablet vs. Powdered). The levels for temperature was 10 and 50 C and levels for Coke Concentration was 0 and 30 %.

Note all main effects, two and three factor interactions are significant. The magnitude of the effects are shown in the table below

# Advantages of Case study integration with JMP Journal

- The instructor version provides all the additional resources in one location
- Since the case study is presented in the form of an electronic workbook, the trainee is able to understand the task on hand, conduct the experiments, document and analyze and store the results for instructor review
- The JMP journal is convenient for presenting results
- Enhances fluency in the use of JMP
- Provides the trainee with a single reference location to refer back to at a later point in their training or beyond

# Illustrating the Alka Seltzer case study using the JMP Journal

- Use the Alka Seltzer JMP Journal for demonstration

# Conclusions

- Following the Kolb's model this approach facilitates adult learning
- The use of the Alka Seltzer system provides one case study to illustrate multiple statistical tools
- The exercise allows the user to experience the whole DMAIC process in sync with class room training and individual projects
- Makes a seamless connection between the classroom exercises and statistical tools
- The use of the JMP throughout the learning process enhances fluency
- JMP Journal feature is useful to present the case study in the form of an electronic laboratory workbook which helps to analyze, archive and present results
- The JMP journal facilitates instructors review
  - The ability to quickly add more detail for the instructor