

Technical Report Writing Workshop



Presented by: Nicholas Kutac

Workshop Agenda

Please feel free to ask questions via the hand function or by voice during the presentation

Introduction

- Presenter Background

Presentation

- Mistakes in Report Writing
- The Importance of Storytelling
- Using the DMAIC Framework for Scientific Storytelling

Workshop

- Opportunity to Practice DMAIC Storytelling
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Presenter Background: Nicholas Kutac

Supercomputing Challenge Alumni

- Rio Rancho High School Team #77 (2005-2006)
- [Analytical Fire Modeling: Fire in its Environment](#)

Education

- High School Diploma, Rio Rancho High School (2006)
- Bachelors in Mechanical Engineering, New Mexico State University (2011)
- Masters in Industrial Engineering, New Mexico State University (2013)

Work Experience

- Los Alamos National Laboratory (Summers of 2006 - 2013)
- Puget Sound Naval Shipyard (2013 - Current)

Personal Life and Hobbies

- Living in Washington state, married to a NASA scientist, have a newborn baby boy of three months old we recently adopted
- Enjoy cooking, gardening, sewing, home improvement, and traveling

Mistakes in Report Writing

Common Mistakes in Report Writing

Spelling and Grammar

- cause its vary dstrecting, too reed speeling, 'n gramer mistkes!!!

First Person Statements

- Because there is no “I” in Team and no “We” in Technical

Too Many Filler Statements

- Don't overthink it, try to get fancy, or write to fill space

Not Giving Credit Where Credit is Due

- Citation Citation Citation! Bibliographies demonstrate your knowledge of the subject.

Overstating, Overpromising, or Over-emphasizing ideas, implications, or results

- Science and engineering is all about incremental improvements. There is no such thing as a home run.

Content Oversights: Figures and Pictures

“A picture is worth a thousand words” - Fred R. Barnard (attributed)

Good use of Pictures

- A simple figure that demonstrates the text of an entire section in a single image.
- An easily understood picture/figure that conveys the entire findings of a report is the holy grail of technical report writing.

Poor use of Pictures:

- Too many pictures can be distracting and overwhelming or even meaningless

Use of Captions

- Always remember to caption pictures with a title, reference, and source.

Content Oversights: Displaying Data

Choosing the Best Way to Represent Data

- Tables: Great for comparisons of small data sets or attribute (color/shape) data
- Bar Graphs: Perfect for displaying comparisons of larger data sets
- Line Graphs: Great for showing how data changes over time
- Pie Graphs: Ideal for emphasising a single part of a whole set of data

When to Imbed in the body of a Report or put in the Appendix

- Body: Small data sets are good as tables in the report to demonstrate a point in the text without overwhelming the reader.
- Appendix : Large Data Sets are good in the appendix so that others can reproduce your work in the future.

The Importance of Storytelling

What is Storytelling?

Have you ever read a book or watched a movie where there is no build up and the narrator or story only tells you the final outcome?

Think about what is lost in Cinderella when a storyteller jumps to the end without the proper storytelling...it might go something like this:

“The glass slipper fit on Cinderella’s foot so Prince Charming asked her to marry him. They had a big wedding and lived happily ever after.”

What important developments or lessons learned are missing?

- Character development (Fairy Godmother, Mice, Stepsisters)
- All the good/bad things that happened (Mice making her dress, dress ripped up, magical dress/carriage)
- The lessons learned and struggles Cinderella and the Prince went through.

What questions would you have?

- Why did the prince want to marry her because the slipper fit?

The Importance of Storytelling in Science

Writing a technical report is a lot like telling a story with characters, plot, consequences, and outcomes.

The technical report equivalent of the Cinderella story might go something like this:

“The simulation model showed that the more wolves there are the faster the rabbits go extinct.”

What important developments or lessons learned are missing?

- Assumptions built into the model in the design phase
- Problems with variable selections like number of rabbits/wolves
- Difficulties with the modeling of movements and interactions

What questions would you have?

- Was there a correlation in rabbit/wolf populations?
- What was the purpose and objective of the simulation and study?
- Where can the team go from here to build on what they’ve learned?

Keeping the End in Mind with Storytelling

The primary objective of any technical report is telling your team's story in a clear and concise document that does not require you to answer any questions by the reader and is useful for years in the future without any of the team there to explain the background.

A technical report should describe all of the following qualities to someone who knows nothing about the topic:

- Why the problem needed to be investigated
- What the situation was before the team began their investigation
- How the team went about investigating the problem
- What assumptions were made as part of the data collection and model building
- What was discovered by the team as they investigated the problem
- What can be done in the future after this study now that the team has moved on to other things

If you asked your grandparents, an aunt/uncle, or a teacher to read your report, would they understand the entire project without having to ask the team any questions?

Using the DMAIC Framework

What is the DMAIC Framework?

DMAIC is a structured approach to problem solving used in industry.

Using the DMAIC structure can allow you to tell the story of your progress.

- **Define:** What was the problem that needed to be solved?
- **Measure:** What are the current attributes of the problem to be solved?
- **Analyze:** What are the variables that the study will be changing and why?
- **Improve:** What are the differences between the original and the new states?
- **Control:** What are the recommendations for those affected or new studies needed?

Define:

- What was the problem that needed to be solved?

Measure:

- What are the current attributes of the problem to be solved?

Analyze:

- What are the variables that the study will be changing and why?

Improve:

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D-MAIC: Define

Storytelling in Define

- What was the original idea or concept you wanted to explore or learn about?
- What is the problem being investigated?
- What has been done previously?
- What are the current conditions of the problem?
- Why is it important to investigate the problem now?

Sections of the Report Needed for the Challenge

- An executive summary that is shorter than one page (Abstract)
- A statement of the problem that you have investigated (Background)

Define:

- What was the problem that needed to be solved?

Measure:

- What are the current attributes of the problem to be solved?

Analyze:

- What are the variables that the study will be changing and why?

Improve:

- What are the differences between the original and the new states?

Control:

- What are the recommendations for those affected or new studies needed?

D-M-AIC: Measure

Storytelling in Measure

- What are the assumptions that have been made in the model?
- What real-world data was available to use as part of the model?
- How will the data be used to create a model that can validate the real-world data?

Sections of the Report Needed for the Challenge

- A discussion of how you verified and validated your model
- The software, references, tables, and other products of your work

Define:

- What was the problem that needed to be solved?

Measure:

- What are the current attributes of the problem to be solved?

Analyze:

- What are the variables that the study will be changing and why?

Improve:

- What are the differences between the original and the new states?

Control:

- What are the recommendations for those affected or new studies needed?

DM-A-IC: Analyze

Storytelling in Analyze

- What will the model be testing or exploring?
- What are the variables that are being modified between the validated model and the experiment?
- What are the assumptions that are being built into the experiment?

Sections of the Report Needed for the Challenge

- A description of the method you used to solve your problem
- The software, references, tables, and other products of your work

Define:

- What was the problem that needed to be solved?

Measure:

- What are the current attributes of the problem to be solved?

Analyze:

- What are the variables that the study will be changing and why?

Improve:

- What are the differences between the original and the new states?

Control:

- What are the recommendations for those affected or new studies needed?

DMA-I-C: Improve

Storytelling in Improve

- What was discovered from the simulation and modeling?
- What was the difference between the validated current state and the proposed future state?
- How will you use the findings to make recommendations for action to decision makers?
- What tables/graphs and analysis support your findings?

Sections of the Report Needed for the Challenge

- The results of your study (Results)
- The conclusions you reached by analyzing your results

Define:

- What was the problem that needed to be solved?

Measure:

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Analyze:

- What are the variables that the study will be changing and why?

Improve:

- What are the differences between the original and the new states?

Control:

- What are the recommendations for those affected or new studies needed?

DMAI-C: Control

Storytelling in Control

- What would you do differently if you did the project again?
- What do you want to try or explore next?
- What changes would you recommend making as a result of your study?
- How will the changes you recommend be sustained over time?

Sections of the Report Needed for the Challenge

- Your most significant achievement on the project
- An acknowledgment of the people and organizations that helped you

DMAIC Framework In Action (Example)

Define:

What was the problem that needed to be solved?

Measure:

What are the current attributes of the problem to be solved?

Analyze:

What are the variables that the study will be changing and why?

Improve:

What are the differences between the original and the new states?

Control:

What are the recommendations for those affected or new studies needed?

Define:

Assembly line is not producing at the desired 50 widgets per day.

Measure:

Assembly line is producing 30 widgets per day.

Analyze:

Model the addition of three new machines and predict the new output rate.

Improve:

Original condition was 30 widgets per day, model predicts that new state is 45 widgets per day.

Control:

Recommend adding three new machines and examine other factors to achieve 50 widgets per day.

Workshop

Workshop

Opportunity for teams to practice creating their DMAIC storytelling statements:

- **Define:** What was the problem that needed to be solved?
- **Measure:** What are the current attributes of the problem to be solved?
- **Analyze:** What are the variables that the study will be changing and why?
- **Improve:** What are the differences between the original and the new states?
- **Control:** What are the recommendations for those affected or new studies needed?

Wrap Up!

Contact me for more information,
questions, or if you'd like a review
of your report

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