

Finding Quantitative Literacy in Your Program

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September 19, 2016

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QL is not the same as Math

Quantitative Literacy is not the same as math.

The following case study shows how math skills without good QL can have dire consequences.

Case Study: Challenger Space Shuttle Disaster

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- Recommended against launching Challenger, providing 13 charts as evidence
- NASA rejected the recommendation

Case Study: Challenger Space Shuttle Disaster

On January 28, 1986 the Challenger exploded minutes after launch when the O-rings failed.

Seven astronauts were killed.

Why did this happen?

A Failure to Communicate

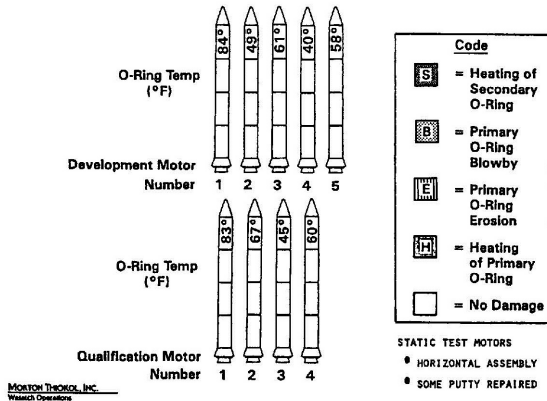
- The engineers had no problem doing the math. The problem was, they could not effectively present their quantitative evidence.

A Failure to Communicate

- The engineers had no problem doing the math. The problem was, they could not effectively present their quantitative evidence.
- The Challenger Disaster was a Quantitative Literacy failure.

Morton Thiokol's First Bad Graphic (1986)

History of O-Ring Damage in Field Joints

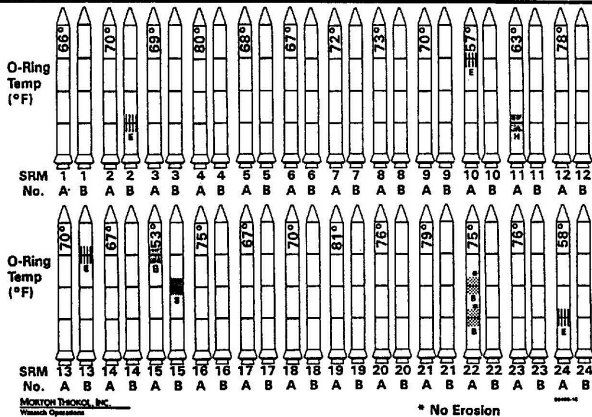


MORTON THIOKOL, INC.
Watch Operators

INFORMATION ON THIS PHOTO WAS PREPARED TO SUPPORT AN ORAL PRESENTATION
AND CANNOT BE CONSIDERED COMPLETE WITHOUT THE ORAL DISCUSSION

Morton Thiokol's Second Bad Graphic (1986)

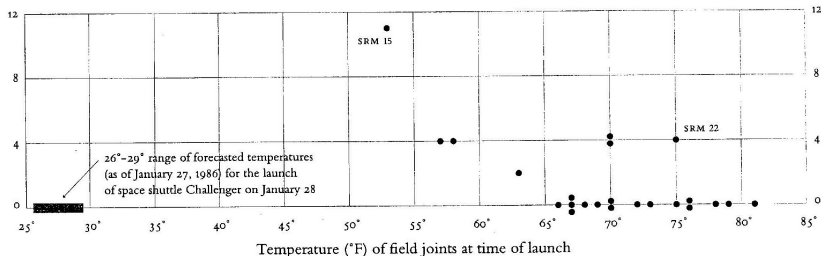
History of O-Ring Damage in Field Joints (Cont)



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Tufte's Good Graphic (1997)

O-ring damage
index, each launch



(Visual and Statistical Thinking, E. Tufte)

Definition

Quantitative Literacy comprises the ability to appropriately extract, interpret, evaluate, construct, communicate, and apply quantitative information and methods to solve problems, evaluate claims, and support decisions in students everyday professional, civic, and personal lives.

QL Criteria 1-3

- 1 **Calculate:** Perform mathematical calculations correctly (and evaluate/confirm that they have done so).
- 2 **Interpret:** Extract and interpret quantitative information presented in various commonly used forms (e.g., equations, graphs, diagrams, tables, prose).
- 3 **Construct Representations:** Convert relevant quantitative information and data into different forms as appropriate (e.g., equations, graphs, diagrams, tables, prose).

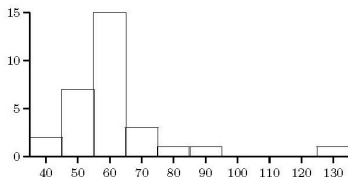
QL Criteria 4,5

- ④ **Apply in Context:** Apply appropriate quantitative methods, draw justified conclusions, evaluate claims, and make decisions based on quantitative information. Make and evaluate key assumptions in estimation, modeling, and data analysis.
- ⑤ **Communicate:** Effectively and accurately communicate quantitative information in writing and verbally using representations (e.g., equations, graphs, diagrams, tables, prose) that are appropriate for their intended audience.

Histogram

What QL criteria are satisfied by the following problem?

2. The histogram below represents the 2006/7 total player payroll for the thirty NBA teams (in millions of dollars).

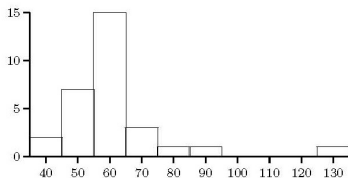


Which do you think is greater: **average** team salary or **median** team salary?
Why?

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QL Criteria:

2. Interpret

Linear Correlation

What QL criteria are satisfied by the following problem?

5. Below are the teams in the NBA's Southwest division, the number of points they allow their opponents to score (on average), and their wins. Also included are the averages and sample standard deviations for both points allowed and wins, as well as most of the z -scores.

	P.A.	Wins	z_{pa}	z_{wins}
Dallas	92.8	67	-0.44665	1.10488
San Antonio	90.1	58	-0.85407	0.59231
Houston	92.1	52	-0.55228	0.25059
New Orleans	97.1	39	0.20220	-0.48979
Memphis	106.7	22		
Average	95.76	47.6		
Std Dev	6.6271	17.5585		

- (b) Mathematically, which statistic was the more remarkable: San Antonio's remarkably low points allowed or Dallas' remarkably high number of wins? Why?
- (e) In terms of points allowed and wins interpret the slope (in words).

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Correlation and Cause

What QL criteria are satisfied by the following problem?

6. (Token non-NBA question) At both the United Arab Emirates University and at OIT the following recommendation was made:

“Students with good English language skills tend to also do well in mathematics, while those with poor English skills do poorly. There is a clear positive correlation between English skills and math skills.

Therefore we should require every entering student to pass a comprehensive English skills test before they begin their math curriculum.”

Do you agree with this recommendation? Discuss it from the standpoint of statistics.

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QL Criteria:

5. Communication

Hypothesis Testing

What QL criteria are satisfied by the following problem?

1. A series of polls administered at the end of 2005 showed that 68% of Afghans strongly approved of their president, Mohammed Karzai. After a series of security problems some journalists suspect that the proportion of Afghans who strongly support Karzai has dropped. A recent poll of 2097 Afghans showed that 1154 of them still strongly support their president.
 - (a) What is the null hypothesis, H_0 , and the alternative hypothesis, H_1 ?
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QL Criteria:

4. Application in Context

Your Turn

Do you have a course that may have QL content?

What QL criteria are covered by your assignments?