# Module 1

# OPERATIONAL DEFINITIONS

## What is an Operational Definition?

An Operational Definition gives communicable meaning to a concept by specifying how the concept is measured and applied within a particular set of circumstances. This definition highlights two important things about an Operational Definition (Viewgraph 1):

- It gives a precise meaning to the spoken or written word, forming a "common language" between two or more people.

- It defines how a word or phrase is used when it is applied in a specific context. This implies that words may have different meanings when used in different situations. For example, the Operational Definition of "ready" used in an air squadron would be very different from the one applied in a naval hospital.

Strictly speaking, Operational Definitions aren't "tools" in the same sense that Affinity Diagrams, Flowcharts, Pareto Charts, and Histograms are. However, they are the vital underpinning that helps us to use all of these other tools successfully.

Viewgraph 2 illustrates what can happen when a word or phrase is not understood in the same way by everyone on a team.

# What Is an Operational Definition?

A definition that gives communicable meaning to a concept by specifying how the concept is measured and applied within a particular set of circumstances.

(Deming, 1986)

"Our troubles are over, coach. I found us a 7-footer ..."

## Why should a team use Operational Definitions?

Operational Definitions put workable meaning into our everyday terminology. Words such as "good," "reliable," "defect," and "uniform" can have many meanings unless they are defined in specific terms that apply in particular circumstances. As an example, in the absence of an Operational Definition, the term "squared away" might mean one thing to an Executive Officer immediately prior to the visit of a VIP, and quite another to a young sailor involved in preparing for the visit but anxious to start a three-day weekend. However, if "squared away" were operationally defined among all of those getting the ship ready for the VIP, the term would mean the same thing to the Exec and the sailor.

To communicate effectively and avoid misinterpretations, members of your team, data collectors, and both internal and external customers and suppliers must use the same Operational Definitions for the same concepts.

A review of the Data Collection module will help make it clear that everyone involved in improving a process must be working from a common set of definitions. Misunderstandings waste time; but worse, they add variation to your process. Consequently, it is vitally important to develop Operational Definitions at each step of the Process Improvement Flowchart in the new Handbook for Basic Process Improvement.

## What are the elements of an Operational Definition?

An Operational Definition has three elements that help you to apply it (Viewgraph 3):

- Criterion: The standard against which to evaluate the results of the test.

- Test: A specific procedure for measuring a characteristic.

- Decision: The determination as to whether the test results show that the characteristic meets the criterion.

 

# Elements of an
# Operational Definition

- **Criterion:**  Standard against which to evaluate results of the test

- **Test:**  Procedure for measuring a characteristic

- **Decision:**  Determination whether test results show the characteristic meets the criterion

# How is an Operational Definition developed?

The following example, based in part on W.E. Deming's discussion of Operational Definitions [Ref. 1, pp. 287-290], illustrates how you can establish one or more criteria, measure, and reach a decision:

What is meant when a blanket label says "50 percent wool"?

One interpretation might be that one-half of the area of the blanket is wool and the other half is another material, such as cotton.

Another interpretation might be that the wool is evenly dispersed throughout the entire blanket.

Still another interpretation might be that the blanket is two-ply, with one side made entirely of wool and the other side made of cotton.

In the absence of more information, any of these definitions could be "correct."  But what do you want your blanket to be like?  You and your team won't get what you want unless you develop an Operational Definition (Viewgraph 4) of what is meant by the term "50 percent wool."

- Criterion:  First, you need to set the criterion or standard for calling the blanket "50 percent wool."  In this example, the criteria are that the wool and cotton fibers are evenly distributed throughout the blanket and the wool comprises half the total weight of the blanket.  Other criteria could have been used, such as the number of threads of wool compared to the number of threads of cotton.

- Test:  After you have decided on the criteria for "50 percent wool," you must set up a test procedure to determine whether the blanket meets the criteria.  In this example, the decision was made to use a quantitative test in which ten 2-inch-by-2-inch squares were cut from specified areas in sample blankets.  These swatches were handed over to a laboratory technician to analyze and measure the proportion of wool by weight.

- Decision:  Now you must make a decision.  When the laboratory technician has performed the test on the samples and presented you with the data, it becomes a yes-or-no decision:  Did the results of the test meet the criteria?

Viewgraph 5 provides you with a worksheet to use when your team is developing Operational Definitions.

# Developing an
# Operational Definition
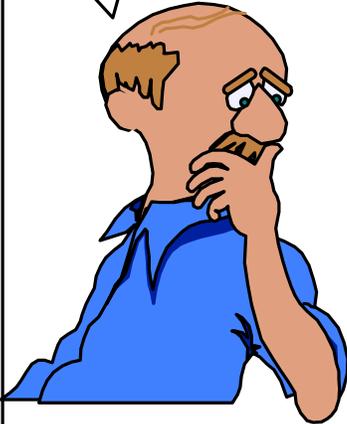
We want a 50% wool blanket.

- Criteria - Wool fibers evenly distributed & comprise half the blanket's weight.

- Test - Analysis of samples measures distribution & proportion of fibers.

- Decision - Wool fibers evenly distributed & comprise half the weight. Blanket is 50% wool.

## Worksheet
## Operationally define the term:

Criterion: _____
_____
_____
_____
_____

Test: _____
_____
_____
_____
_____

Decision: _____
_____
_____
_____
_____

## Why should we go through this rigorous process?

"An operational definition is one that people can do business with....(It) must be communicable, with the same meaning to vendor as to purchaser, same meaning yesterday and today..." [Ref.1, p. 277]. In other words, a correctly formulated operational definition enables all of the people involved in a transaction to use and understand a term in exactly the same way every time.

This becomes especially important when you are collecting data. Each person on your team may have a different idea about what constitutes a defect. But when you have established the criteria for what is acceptable and the test procedure for separating what is acceptable from what is defective, all team members can determine what is and is not a defect.

By extension, we can see that Operational Definitions are relevant only within the particular circumstances you are examining. To illustrate this concept, let's look at another of Dr. Demings examples [Ref. 2]:

What is a clean table?

If you are using the table as a workbench, then clean may only mean that it is free of clutter. On the other hand, if it is a lunch table, you would want some level of cleanliness which is achieved by using a mild detergent. If it is an operating room table, it would have to be antiseptically clean to prevent the spread of infection. The Operational Definition of clean is quite different for each of these situations, so you can see that context is important.

## How can we practice what we've learned?

As you practice developing Operational Definitions using the exercises that follow, keep in mind that there are no standard or right answers.  You can use the worksheet in Viewgraph 5 to develop your own Operational Definitions for the terms in the exercises.  Some possible answers are provided in Viewgraphs 6 through 10.

EXERCISE 1 - The ship's First Lieutenant was conducting a training session on preparing a metallic surface for painting, stressing the requirement that the surface must be rust-free.  Operationally define the term rust-free (Viewgraph 6).

EXERCISE 2 - A quality improvement team at a medical clinic pharmacy was attempting to improve its process by making prescription service as fast as possible.  Operationally define the term fast in this context (Viewgraph 7).

# Exercise 1 - Possible Answer

## Operationally define the term

## Rust-free

Criterion: The absence of any visible oxidation on the surface of the metal

Test: Under good lighting conditions, a person with 20/20 vision examines the surface of the metal for evidence of oxidation.

Decision: If no oxidation is observed, the criterion is met. The surface is rust-free.

# Exercise 2 - Possible Answer
## Operationally define the term
## Fast (pharmacy service)

Criterion: Medication is dispensed at the customer service window no more than 10 minutes after the prescription is turned in at the pharmacy.

Test: The time to fill a prescription is determined using a calibrated stopwatch.

Decision: If the medication is dispensed no more than 10 minutes after receipt of the prescription, the criterion is met. Pharmacy service is fast.

EXERCISE 3 - A rotating piece of machinery requires oil to lubricate the surfaces of its bearings.  Operationally define the term satisfactory as it relates to oil lubrication for a bearing.  Try doing this using two different criteria:

a.  Oil flow (Viewgraphs 8)

b.  Oil pressure (Viewgraph 9)

Exercise 3a - Possible Answer

Operationally define the term

Satisfactory (oil lubrication)

Criterion:   Evidence of oil in the bearing's sight flow
             indicator

Test:        Under good lighting conditions, oil flow is
             observed with the naked eye in the sight
             flow indicator.

Decision:    If oil flow is observed, the criterion is met.
             Oil lubrication is satisfactory.

Exercise 3b - Possible Answer

Operationally define the term

Satisfactory (oil lubrication)

Criterion:   Minimum of 15 PSIG of lube oil pressure
             at the most remote bearing

Test:        An observer checks the oil gage pressure
             at the most remote bearing.

Decision:    If the oil gage pressure is at least 15 PSIG,
             the criterion is met.  Oil lubrication is
             satisfactory.

# REFERENCES:

1.  Deming, W.E. (1982). Out of the Crisis, pp. 287-289. Cambridge, MA: Massachusetts Institute of Technology, Center for Advanced Engineering Study.

2.  Deming, W.E. Seminar on Quality, Productivity, and Competitive Position, Student Notebook, p. 47. Wailea, Maui, HI, 12-15 JAN 1993. Los Angeles, CA: Quality Enhancement Seminars, Inc.

3.  Department of the Navy (November 1992), Fundamentals of Total Quality Leadership (Instructor Guide), pp. 5-23 - 5-24. San Diego, CA: Navy Personnel Research and Development Center.

4.  Department of the Navy (September 1993). Systems Approach to Process Improvement (Instructor Guide), pp. 2-21 - 2-29. San Diego, CA: OUSN Total Quality Leadership Office and Navy Personnel Research and Development Center.

5.  Scholtes, P.R., et al (1988). The Team Handbook, pp. 2-28 - 2-29. Madison, WI: Joiner Associates.
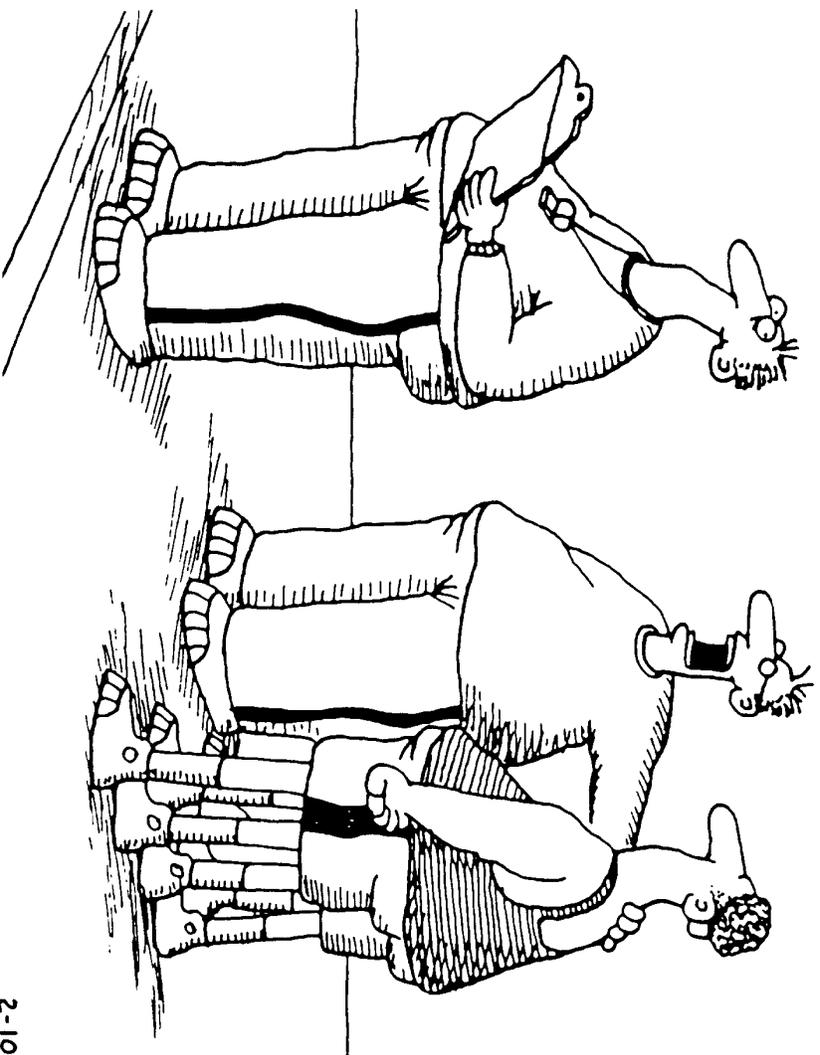
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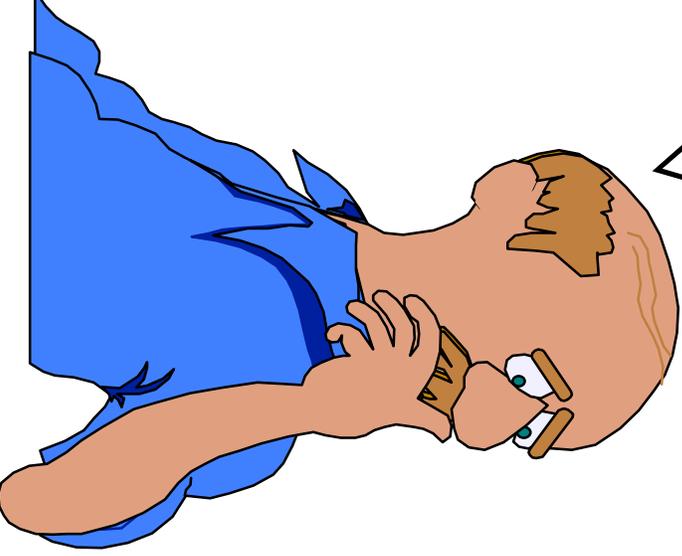7-footer ..."

2-10

# Elements of an Operational Definition

- Criterion: Standard against which to evaluate results of the test

- Test: Procedure for measuring a characteristic

- Decision: Determination whether test results show the characteristic meets the criterion

# Developing an
# Operational Definition

*We want a 50% wool blanket.*

- Criteria - Wool fibers evenly distributed & comprise half the blanket's weight.

- Test - Analysis of samples measures distribution & proportion of fibers.

- Decision - Wool fibers evenly distributed & comprise half the weight. Blanket is 50% wool.

# Worksheet

## Operationally define the term:

_____

**Criterion:** _____

**Test:** _____

**Decision:** _____

# Exercise 1 - Possible Answer

# Operationally define the term

## Rust-free

**Criterion:** The absence of any visible oxidation on the surface of the metal

**Test:** Under good lighting conditions, a person with 20/20 vision examines the surface of the metal for evidence of oxidation.

**Decision:** If no oxidation is observed, the criterion is met. The surface is rust-free.

# Exercise 2 - Possible Answer
## Operationally define the term
# Fast (pharmacy service)

**Criterion:** Medication is dispensed at the customer service window no more than 10 minutes after the prescription is turned in at the pharmacy.

**Test:** The time to fill a prescription is determined using a calibrated stopwatch.

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# Exercise 3a - Possible Answer

## Operationally define the term

# Satisfactory (oil lubrication)

**Criterion:** Evidence of oil in the bearing's sight flow indicator

**Test:** Under good lighting conditions, oil flow is observed with the naked eye in the sight flow indicator.

**Decision:** If oil flow is observed, the criterion is met. Oil lubrication is satisfactory.

# Exercise 3b – Possible Answer

# Operationally define the term
# Satisfactory (oil lubrication)

Criterion: Minimum of 15 PSIG of lube oil pressure
at the most remote bearing

Test: An observer checks the oil gage pressure
at the most remote bearing.

Decision: If the oil gage pressure is at least 15 PSIG,
the criterion is met. Oil lubrication is
satisfactory.