TQM Tools

Prepared by:

Ziyad Bahamdan

King Fahd University of Petroleum & Minerals

جامعة الملك فهد للبترول و المعادن

Prepared for:

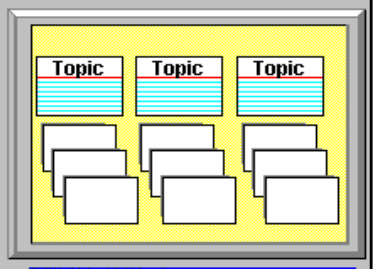
Prof. Abdulaziz Bubshait

AFFINITY DIAGRAM

What is it?

The *AFFINITY DIAGRAM* is used to organize facts, opinions, and ideas into groups or topics. It provides a framework for organizing results from customer feedback cards, survey comments, brainstorming sessions, etc., so that many ideas may be easily structured and restructured.

An *AFFINITY DIAGRAM* is created by selecting a theme, collecting facts, opinions, and ideas, and then transferring the data onto index cards or adhesive notes which are sorted and labeled.



Click on graphic to hear audio.

RESULTS:
The team now has

- *a theme or pattern to otherwise unorganized data*
- *a way to quantify qualitative information*

AFFINITY DIAGRAM

When do I use it?

Sort large quantities of data.

Look for patterns or themes.

The *AFFINITY DIAGRAM* is used when you need to sort large quantities of qualitative data. The data may come from customer feedback forms, survey comments, brainstorming sessions, etc.

Click on the situation you want to explore further.

AFFINITY DIAGRAM

When do I use it?

Sort large quantities of data.

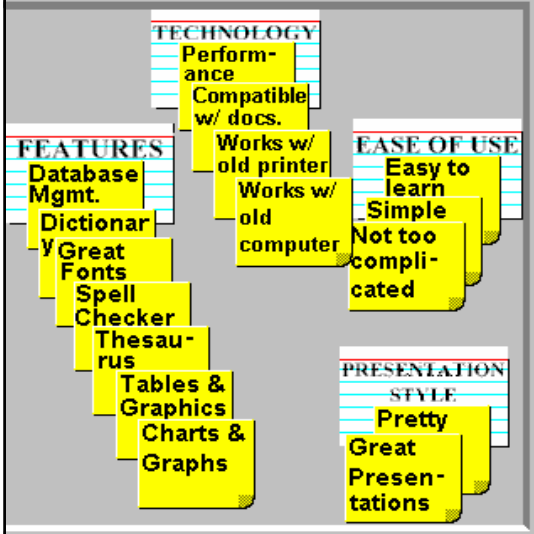
Look for patterns or themes.

Creating an *AFFINITY DIAGRAM* requires you to categorize the data you have gathered. This allows themes or patterns of responses to be recognized.

Click on the situation you want to explore further.

AFFINITY DIAGRAM

How do I build it? Summary



Step 1: Put each piece of nominal data collected from surveys, interviews or brainstorming sessions on a separate card or adhesive note.

Step 2: Working together, each team member then silently sorts the cards into loosely related piles.

Step 3: Once sorting is complete, make a topic card for each pile.

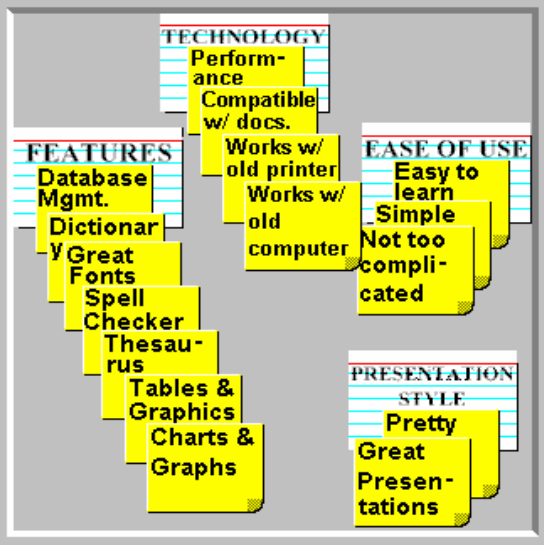
Step 4: Re-evaluate the card sort and remove any cards that do not fit.

Step 5: Re-sort discards and label them.

Done

AFFINITY DIAGRAM

Example

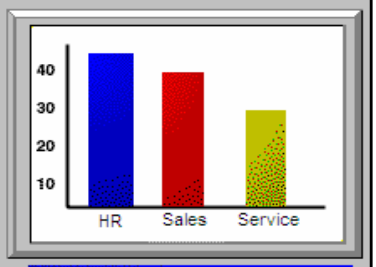


Replay

BAR CHART

What is it?

A *BAR CHART* compares categories of data. The bars represent each category and the height of the bar is relative to that categories data value. The bars do not touch or overlap each other.



Click on graphic to hear audio.

RESULTS:

The team now has

- *a visual for comparing categories of data*

BAR CHART

When do I use it?

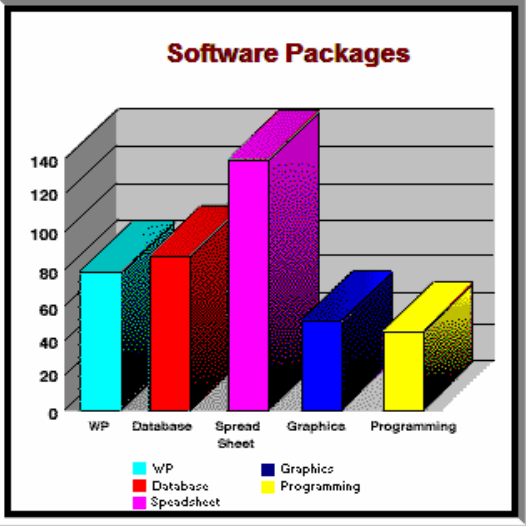
Easily compare categories.

BAR CHARTS are useful to use when one needs to effectively display and easily compare categories of data.

Click on the situation you want to explore further.

BAR CHART

How do I build it? Summary



Step 1: Collect nominal, ordinal, or yes/no data using a check sheet.

Step 2: List the categories (usually words rather than numbers) across the horizontal scale.

Step 3: Set the vertical scale to the left by finding both the largest and smallest value from the data and make sure the scale is broad enough to include both. Divide the scale into equal intervals. Label the vertical scale by identifying the type of measurement reported.

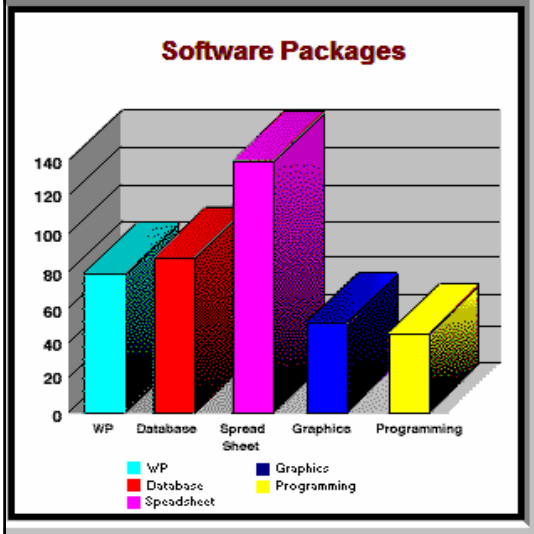
Step 4: Draw the bars for each of the categories by making the height of the bars relative to the data value of that particular category.

Step 5: Add a descriptive title to the chart and include any "legends" that show what any different patterns or colors may represent.

Done

BAR CHART

Interpretation Question



Based on use, which software package should the company upgrade first?

- WP
- Data Base
- Spread Sheet
- Graphics

Click on your answer.

Replay

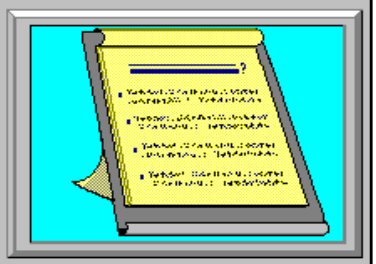
BRAINSTORMING

What is it?

BRAINSTORMING is a group technique for generating original ideas in an uninhibited atmosphere. The goals are to:

- generate an extensive number of ideas
- involve everyone in the process
- promote a common understanding

BRAINSTORMING is used to help a team create as many ideas as possible in as short a time as possible; the length of the session should be about 15 minutes.



Click on graphic to hear audio.

RESULTS:
The team now has

- *lists of ideas that can be critiqued, edited for duplications, and ranked from most important to least important*
- *creative solutions to problems based on input from all team members*

BRAINSTORMING

When do I use it?

Design an improved process and analyze and evaluate current processes.

Generate ideas and gather input from a group.

Through *BRAINSTORMING* the team can generate new ideas and creative solutions to specific processes and problems. Ideas and solutions can then be critiqued, edited, prioritized, and rank ordered.

Click on the situation you want to explore further.

BRAINSTORMING

When do I use it?

Design an improved process and analyze and evaluate current processes.

Generate ideas and gather input from a group.

BRAINSTORMING allows a group or team to work together to generate ideas. Everyone in the group is involved in the process at the same time, so that ideas are shared and misunderstandings are avoided.

Click on the situation you want to explore further.

BRAINSTORMING

How do I build it? Summary

PROBLEM: How to properly Brainstorm an Idea in a session.

- Solicit ideas from the group. A
- Each person should take a turn contributing ideas. Anyone may pass. B
- Record each idea verbatim. Do not interpret or change ideas C
- When the team has exhausted all ideas the brainstorming session is over. D
- Review the list for comprehension. E
- Using brackets go through each idea asking, "Does this idea deserve further consideration?" F
- Combine like ideas or ideas that are dependent on one another and then label each grouping.

Done

BRAINSTORMING

Example

Skip

BRAINSTORMING

Example

PROBLEM: Trouble selecting a new word processor.

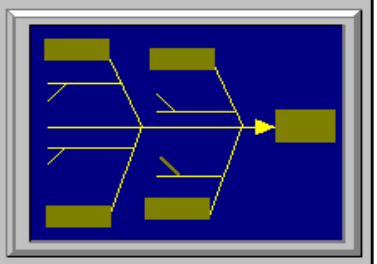
other priorities	A
no follow through	B
not committed	C
unproductive meetings	D
equipment failures	E
individuals are overcommitted	F
lack of supervisor support	G

Replay

CAUSE & EFFECT DIAGRAM

What is it?

A *CAUSE & EFFECT DIAGRAM*, also called a fishbone diagram or an Ishikawa diagram, is a chart of possible causes of a problem. The problem is stated at the right-hand side of the diagram and diagonal lines depict the flow of causes toward one problem or effect.



Click on graphic to hear audio.

CAUSE & EFFECT DIAGRAMS help clarify a process and indicate possible means of improvement. As categories and subcategories are arranged, its logical structure often suggests the root cause to the problem. Subdividing continues until the root cause(s) to the problem is found.

RESULTS:
The team now has

- *probable causes of a problem*
- *help in identifying the root cause of a problem, not just the symptoms*
- *an illustration of the relationship between possible causes*

CAUSE & EFFECT DIAGRAM

When do I use it?

Identify and display all the possible causes of a problem or condition.

Logically sort out the possible causes of a problem or condition and relate them to categories.

The *CAUSE & EFFECT DIAGRAM* is a systematic way for a team to work backwards from the "effect" to all the possible causes.

By repeatedly asking the question "why," the team can find more and more basic causes. The "fishbone" structure of the diagram displays the causes in an easy-to-see manner.

Click on the situation you want to explore further.

CAUSE & EFFECT DIAGRAM

When do I use it?

Identify and display all the possible causes of a problem or condition.

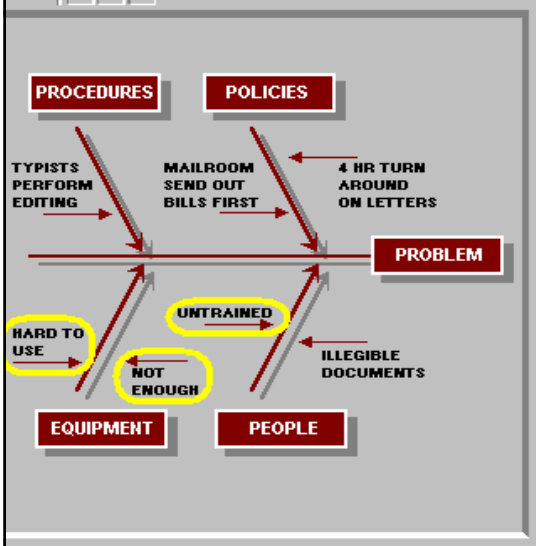
Logically sort out the possible causes of a problem or condition and relate them to categories.

The *CAUSE & EFFECT DIAGRAM* is constructed by thinking through a problem in a logical and systematic manner. The team would start with a set of categories for the ribs and then take each rib in turn, listing possible causes related to that category.

Click on the situation you want to explore further.

CAUSE & EFFECT DIAGRAM

How do I build it? Summary



Step 1: State the problem briefly and place it on the right side of the page with a box around it. Identify the process or task you want to analyze and ask the people most familiar with the process to help construct the chart.

Step 2: Write the main categories in the boxes at the end of the fish's ribs.

Step 3: Generate potential causes within each category through brainstorming and write each potential cause on the horizontal fishbones that intersect the angled ribs.

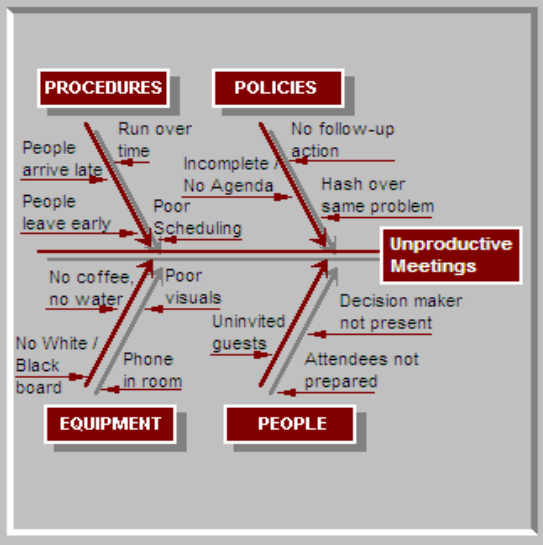
Step 4: Continue exploring the chain of causes by asking "Why?... Why?... Why?..." until the root causes have been determined.

Step 5: Circle the most significant causes in the finished diagram by reaching group consensus.

Done

CAUSE & EFFECT DIAGRAM

Example

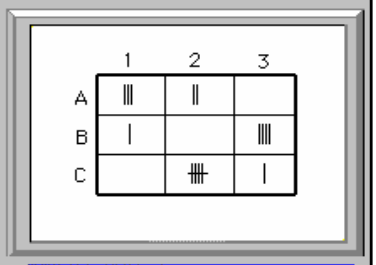


Replay

CHECK SHEET

What is it?

A *CHECK SHEET* is used to determine how often an event occurs over a designated period of time. Although the purpose of a *CHECK SHEET* is to track data and not analyze it, *CHECK SHEETS* often help to indicate any patterns or trends that are present. A *CHECK SHEET* then can be utilized to help a team create other display tools such as: Bar Chart, Pie Chart, Pareto Chart, Scatter Diagram, Run Chart, and Control Chart.



Click on graphic to hear audio.

RESULTS:

The team now has

- *a consistent, organized method to collect data*

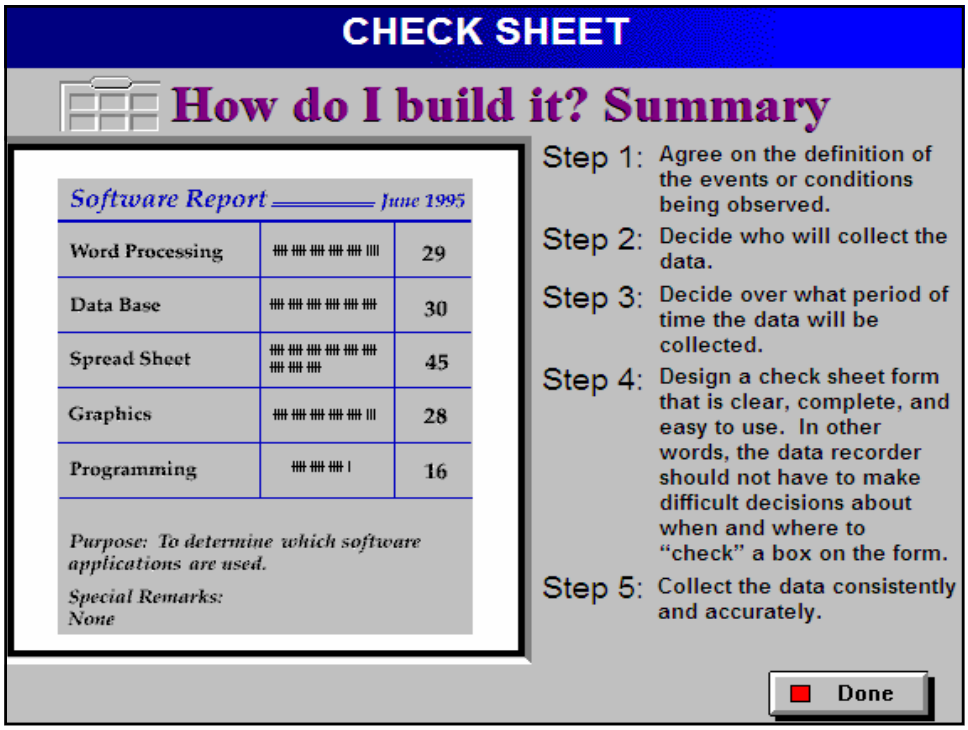
CHECK SHEET

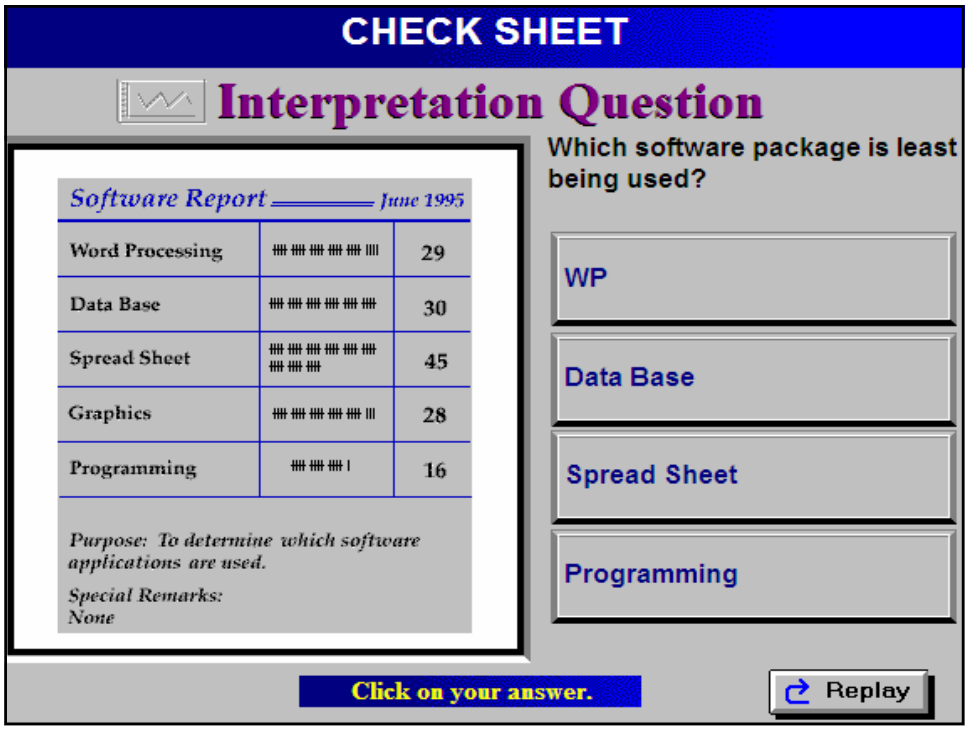
When do I use it?

Record and compile data.

CHECK SHEETS are used when there is a need to systematically record and compile data. *CHECK SHEETS* can sometimes be used to record information that has already occurred in order to sort out the data into a more organized system.

Click on the situation you want to explore further.

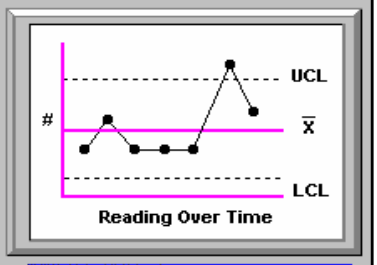

CHECK SHEET
How do I build it? Summary
Software Report June 1995
Word Processing 29
Data Base 30
Spread Sheet 45
Graphics 28
Programming 16
Purpose: To determine which software applications are used.
Special Remarks:
None
Step 1: Agree on the definition of the events or conditions being observed.
Step 2: Decide who will collect the data.
Step 3: Decide over what period of time the data will be collected.
Step 4: Design a check sheet form that is clear, complete, and easy to use. In other words, the data recorder should not have to make difficult decisions about when and where to "check" a box on the form.
Step 5: Collect the data consistently and accurately.
Done


CHECK SHEET
Interpretation Question
Software Report June 1995
Word Processing 29
Data Base 30
Spread Sheet 45
Graphics 28
Programming 16
Purpose: To determine which software applications are used.
Special Remarks:
None
Which software package is least being used?
WP
Data Base
Spread Sheet
Programming
Click on your answer.
Replay

CONTROL CHART

What is it?

A *CONTROL CHART* monitors the performance and variation of a process over time. A *CONTROL CHART* tells you two things: (1) whether your process is operating normally and (2) whether a change has occurred that requires your attention and investigation. A *CONTROL CHART* cannot tell you what has changed, or why there has been a change, only that a change has occurred. There are several different types of *CONTROL CHARTS*. The type of data you have will determine the type of *CONTROL CHART* you should use. One of the most commonly



Click on graphic to hear audio.

Click on the arrow(s) to see more.

RESULTS:

The team now has

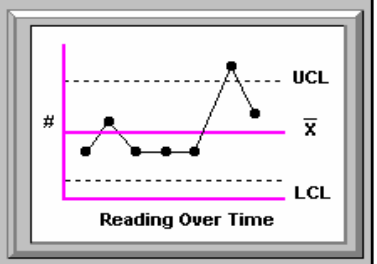
- *a display of data points and process variation over time*
- *a determination of whether a process is in or out of control, signaling you to take such actions as investigating or continue to monitor the process*
- *a monitoring tool; a means of tracking*

CONTROL CHART

What is it?

used control chart is the $\overline{X}$ and R (average and range) chart.

The difference between a Run Chart and a *CONTROL CHART* is that a *CONTROL CHART* allows you to see whether the variation of your process is within calculated limits. The $\overline{X}$ and R control chart is actually two separate charts always shown together. In addition to showing measurements over time, the control chart uses a solid, horizontal line to indicate the center line: the process average ($\overline{X}$) and the



Click on graphic to hear audio.

Click on the arrow(s) to see more.

RESULTS:

The team now has

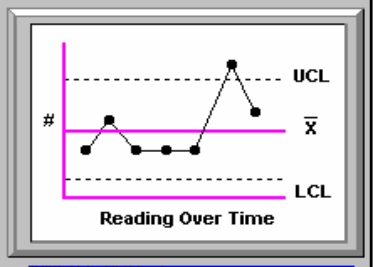
- *a display of data points and process variation over time*
- *a determination of whether a process is in or out of control, signaling you to take such actions as investigating or continue to monitor the process*
- *a monitoring tool; a means of tracking*

CONTROL CHART

What is it?

range average ($\overline{R}$). Also included are the Upper Control Limit (UCL) and the Lower Control Limit (LCL). These control limits are represented by dashed, horizontal lines above and below the process average and range average. They represent the natural boundaries of the process.

The process mean ($\underline{\underline{X}}$) is the total sum of each of the plotted subgroup means divided by the number of plotted points. This is the center line on the average chart.



Click on graphic to hear audio.

Click on the arrow(s) to see more.

RESULTS:

The team now has

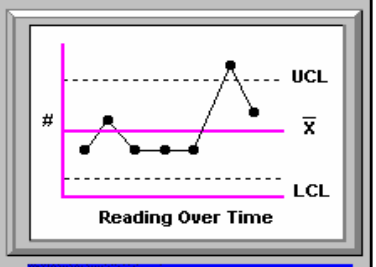
- *a display of data points and process variation over time*
- *a determination of whether a process is in or out of control, signaling you to take such actions as investigating or continue to monitor the process*
- *a monitoring tool; a means of tracking*

CONTROL CHART

What is it?

The range average ($\overline{R}$) is the total sum of each of the plotted range values divided by the number of plotted range values. This is the center line on the range chart.

Control limits are calculated from the data using a statistical formula to help establish the natural boundary for your process.



Click on graphic to hear audio.

Click on the arrow(s) to see more.

RESULTS:

The team now has

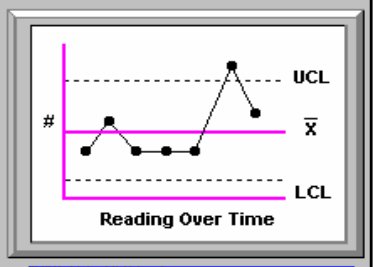
- *a display of data points and process variation over time*
- *a determination of whether a process is in or out of control, signaling you to take such actions as investigating or continue to monitor the process*
- *a monitoring tool; a means of tracking*

CONTROL CHART

What is it?

There are two types of variation: Common Cause (normal) and Special Cause (out of control). In order to help you identify which type of variation your process has you need to divide your control chart into zones.

Each chart (average and range) contains three equal zones above the center line and three equal zones below the center line.



Click on graphic to hear audio.

Click on the arrow(s) to see more.

RESULTS:

The team now has

- *a display of data points and process variation over time*
- *a determination of whether a process is in or out of control, signaling you to take such actions as investigating or continue to monitor the process*
- *a monitoring tool; a means of tracking*

CONTROL CHART

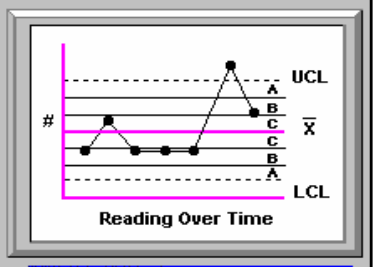
What is it?

Zone A is located closest to the upper and lower control limits.

Zone C is located directly on either side of the center line.

Zone B is located between Zone A and Zone C.

Please note: Zones are always the same width above and below the center line. Range chart may not have enough space below the center line to draw all three zones. Only draw the zones that fit the space.



Click on graphic to hear audio.

Click on the arrow(s) to see more.

RESULTS:

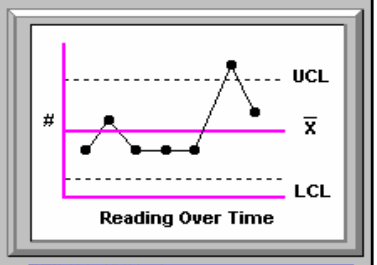
The team now has

- *a display of data points and process variation over time*
- *a determination of whether a process is in or out of control, signaling you to take such actions as investigating or continue to monitor the process*
- *a monitoring tool; a means of tracking*

CONTROL CHART

What is it?

When a process is in control, the data points vary randomly above and below the center line and within the upper and lower control limits. Your process is considered "out of control" when a data point falls beyond the control limits or displays a nonrandom pattern of behavior. This tells you that a special cause is making the process vary beyond what is normal and that you need to investigate and make adjustments to your process.



Click on graphic to hear audio.

Click on the arrow(s) to see more.

RESULTS:

The team now has

- *a display of data points and process variation over time*
- *a determination of whether a process is in or out of control, signaling you to take such actions as investigating or continue to monitor the process*
- *a monitoring tool; a means of tracking*

CONTROL CHART

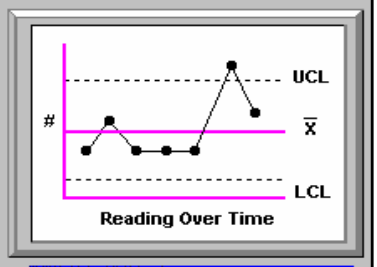
What is it?

Nonrandom patterns:

Run - 7 of 7, 10 of 11, or 12 of 14 points on one side of the center line

Trend - 7 or more consecutive points which continue to rise or fall

Swing - 2 of 3, 3 of 7, 4 of 10 points that move from Zone A on one side of the center line to Zone A on the opposite side of the center line



Click on graphic to hear audio.

Click on the arrow(s) to see more.

RESULTS:

The team now has

- *a display of data points and process variation over time*
- *a determination of whether a process is in or out of control, signaling you to take such actions as investigating or continue to monitor the process*
- *a monitoring tool; a means of tracking*

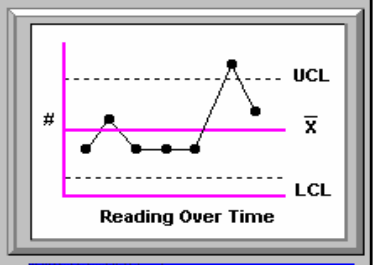
CONTROL CHART

What is it?

Outer Hug - 2 of 3, 3 of 7, 4 of 10 points that are located in either Zone A's

Inner Hug - 14 points in a row or almost all of the data points are located on either side of the center line within both Zone C's

Cycle - consistent pattern of repeated points over a period of time



Click on graphic to hear audio.

Click on the arrow(s) to see more.

RESULTS:

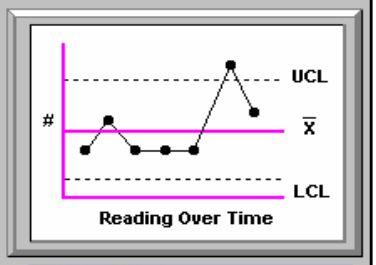
The team now has

- *a display of data points and process variation over time*
- *a determination of whether a process is in or out of control, signaling you to take such actions as investigating or continue to monitor the process*
- *a monitoring tool; a means of tracking*

CONTROL CHART

What is it?

A process which is identified as out of control is not said to be "wrong" or "bad." It is just an indication that the process has changed.



Click on graphic to hear audio.

Click on the arrow(s) to see more.

RESULTS:

The team now has

- *a display of data points and process variation over time*
- *a determination of whether a process is in or out of control, signaling you to take such actions as investigating or continue to monitor the process*
- *a monitoring tool; a means of tracking*

CONTROL CHART

When do I use it?

See whether a process is in statistical control.

Determine where to begin process improvement.

A *CONTROL CHART* allows you to see at a glance whether a process is in control (common cause variation) or out of control (special cause variation). It is important to understand which type of variation your process has in order to make effective changes to your process.

Click on the situation you want to explore further.

CONTROL CHART

When do I use it?

See whether a process is in statistical control.

Determine where to begin process improvement.

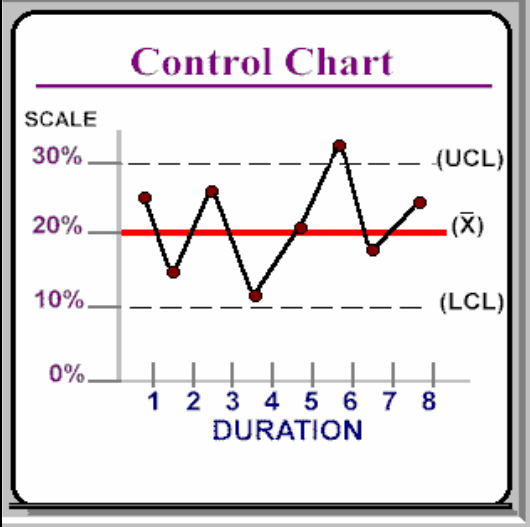
Process improvement should only be applied to processes that are in statistical control, that is they are repeatable and predictable.

Out of control processes need to be investigated and brought back into control before improvement efforts are made.

Click on the situation you want to explore further.

CONTROL CHART

How do I build it? Summary



Step 1: Collect equal size subgroup sample interval data.

Step 2: From each subgroup, calculate subgroup mean ($\bar{X}$) and the range (R).

Step 3: Calculate the center line for each chart: the mean of all the $\bar{X}$ for the average chart ($\bar{\bar{X}}$); and the mean for all the ranges ($\bar{R}$) for the range chart (R).

Step 4: Calculate the control limits for the charts.

Step 5: On a graph, consider the y-axis to be the scale and the x-axis to be time (duration of the process).

Step 6: Plot and label the center line and control limits for each chart.

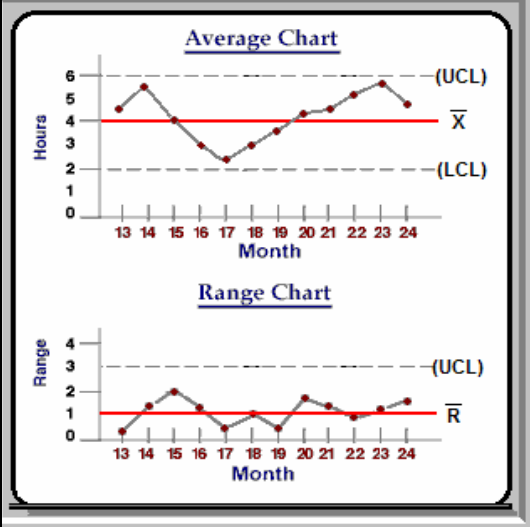
Step 7: Plot each subgroup mean ($\bar{X}$) on the average chart and plot each range value on the range chart. Connect each plotted point.

Step 8: Look for points beyond the control limits and for any nonrandom patterns.

Done

CONTROL CHART

Interpretation Question



This control chart shows which pattern of nonrandom variation?

- Run
- Trend
- Swing

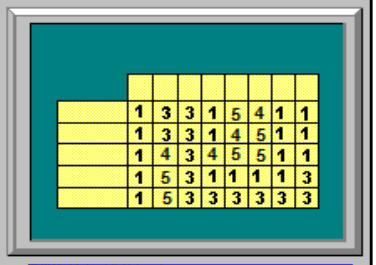
Click on your answer.

Replay

DECISION MATRIX

What is it?

A *DECISION MATRIX* is a type of prioritization matrix. It is an evaluation tool that helps you rate the relative impact or importance of various alternatives.



Click on graphic to hear audio.

RESULTS:
The team now has

- *narrower lists of issues*
- *a method for comparing options using weighted criteria*

DECISION MATRIX

When do I use it?

Evaluate the impact or importance of various options.

Quantify group input.

A *DECISION MATRIX* helps you organize a list of criteria and rank or prioritize them based on a scale. By adding up the total scores, you can easily see your best option or solution presented in numerical form.

Click on the situation you want to explore further.

DECISION MATRIX

When do I use it?

Evaluate the impact or importance of various options.

Quantify group input.

The *DECISION MATRIX* requires the group to assign weighted rankings to alternatives. This helps to prioritize the criteria used for evaluation.

Click on the situation you want to explore further.

DECISION MATRIX

How do I build it? Summary

SOLUTIONS	A	B	C	D	E	F
QUALITY	2	1	3	4	1	5
COST	1	2	1	2	2	2
PEOPLE	1	2	3	2	1	4
Customer Satisfaction	2	2	3	1	4	2
TOTAL	6	7	10	9	8	13

Scale: 5=High and 1=Low

Step 1: Using a grid format, list the decision criteria down the first column. For example, you may use Quality, Cost, People, and Customer Satisfaction.

Step 2: List three to six brainstorming ideas, possible solutions, etc., across the first row.

Step 3: Establish a rating scale.

Step 4: The team should decide if the criteria can be treated equally, or if they can be weighted relative to each other. Weighting factors range from 0.5 to 2.0.

Step 5: The team should discuss each idea / possible solution against each decision criterion. Then place the consensus rating in the appropriate box.

Step 6: Total the scores for each idea/possible solution. The idea/possible solution with the highest score can be the candidate for priority.

Done

DECISION MATRIX

Interpretation Question

	Type Fast	Quality Type	Best Type
SOLUTIONS			
QUALITY	2	5	3
COST	3	4	1
PEOPLE	2	2	2
Customer Satisfaction	1	5	3
TOTAL	8	16	9

Scale: 1=low
5=high

Which package was selected by the team?

- TypeFast
- QualityType
- BestType

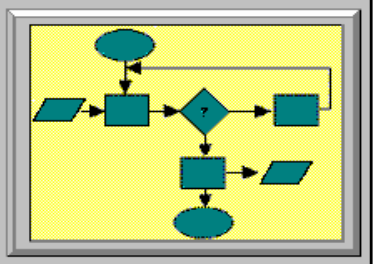
Click on your answer.

Replay

FLOWCHART

What is it?

A *FLOWCHART* is a diagramming tool that is used to trace the steps of an individual process (unlike *Process Maps* which list cross-functional processes) from start to finish. Different symbols, such as rectangles, ovals, and diamonds, indicate each activity as the process moves from the initial input stage to the final output stage of the process.



Click on graphic to hear audio.

FLOWCHARTS allow you to map out a current process and help you to become aware of all the tasks, inputs, outputs, and decisions in a process.

Completed *FLOWCHARTS* can be helpful in finding the root causes of problems.

RESULTS:

The team now has

- *a map of the current process or improved process*
- *an awareness of all the tasks, inputs, outputs, and decisions in a process*
- *an opportunity to examine where re-work or breakdowns may be occurring*

FLOWCHART

When do I use it?

Clarify the actual path and steps performed in a process.

Identify the places in a process where improvements can be made.

A *FLOWCHART* is almost always constructed at the start of a process improvement cycle in order to understand the process under investigation exactly as it is.

Click on the situation you want to explore further.

FLOWCHART

When do I use it?

Clarify the actual path and steps performed in a process.

Identify the places in a process where improvements can be made.

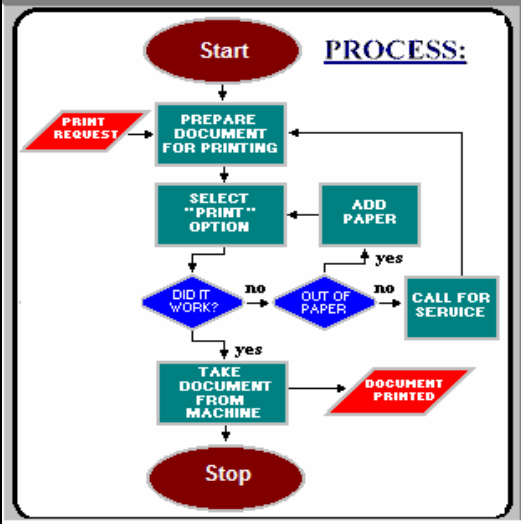
A *FLOWCHART* constructed honestly, with the participation of everyone involved in the process, will almost always reveal areas for possible improvement.

Until the whole process is laid out in the *FLOWCHART*, areas of improvement may be hidden from view, and the people involved in the process unaware that they exist.

Click on the situation you want to explore further.

FLOWCHART

How do I build it? Summary



Step 1: Identify the process or task you want to analyze and ask the people most familiar with the process to help construct the chart.

Step 2: Identify the beginning and end points of the work flow at either end of the drawing area and circle them.

Step 3: Identify necessary inputs to the process and the process outputs.

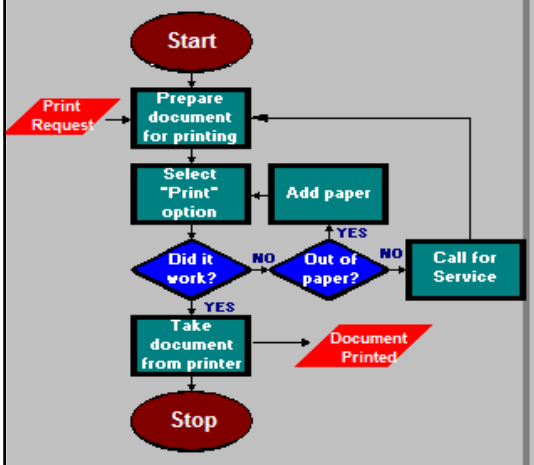
Step 4: Identify and sequence the steps taken to carry out the work flow. Use a rectangle to indicate a task or an action step. Use a diamond to indicate a decision point. Diamonds will have more than one arrow coming from them.

Step 5: Use arrows to indicate the flow of work from one activity to the next. Typically, one arrow comes from a task or an action step.

Done

FLOWCHART

Interpretation Question



After adding paper to the printer, what task would you do next?

- Call for service.
- Select the "Print" option.
- Take the document out of the printer.

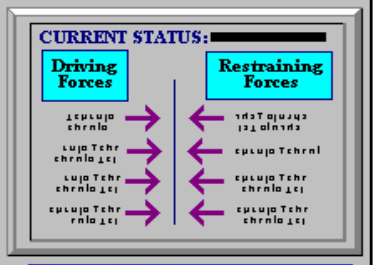
Click on your answer.

Replay

FORCE FIELD ANALYSIS

What is it?

FORCE FIELD ANALYSIS is a technique that identifies those forces that both help (drive) and hinder (restrain) the solution of a problem. It can be useful for identifying potential solutions, and in defining important issues to address in an implementation plan. In traditional *FORCE FIELD ANALYSIS*, "restraining forces" hinder change while "driving forces" move a situation toward change. If the restraining forces are more powerful, change will not occur until those forces have been modified.



Click on graphic to hear audio.

RESULTS:
The team now has

- *a visual framework for examining opposing forces*
- *a basis for planning and effectively implementing change*

FORCE FIELD ANALYSIS

When do I use it?

See the big picture.

Identify potential obstacles to improvement.

A *FORCE FIELD ANALYSIS* can help you define important issues and allows you to consider factors that are hard to quantify.

Click on the situation you want to explore further.

FORCE FIELD ANALYSIS

When do I use it?

See the big picture.

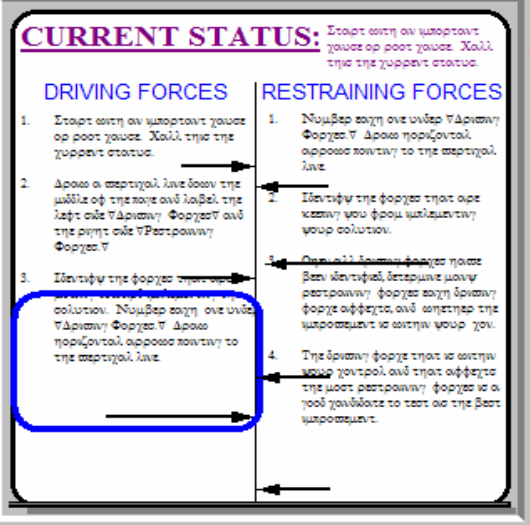
Identify potential obstacles to improvement.

A *FORCE FIELD ANALYSIS* can help identify potential obstacles to improvement and their solutions.

Click on the situation you want to explore further.

FORCE FIELD ANALYSIS

How do I build it? Summary



Step 1: Start with a root cause and call this the current status.

Step 2: Draw a vertical line down the middle of the page and label the left side "Driving Forces" and the right side "Restraining Forces."

Step 3: Identify the forces that are moving toward implementing the solution and list them under "Driving Forces." Draw arrows pointing to the vertical line.

Step 4: Identify the forces that are keeping you from implementing your solution and list them under "Restraining Forces." Draw arrows pointing to the vertical line.

Step 5: When all driving forces have been identified, determine (a) how many restraining forces each driving force affects, and (b) whether the improvement is within your control. If it's within your control, test it as the best improvement.

Done

FORCE FIELD ANALYSIS

Interpretation Question

CURRENT STATUS: *People don't want to switch to new software.*

DRIVING FORCES	RESTRAINING FORCES
promote features of new software →	← I like what I'm using now
upgrade incompatible hardware →	← compatible with existing hardware
provide training →	← already trained on old software
provide facts through PR campaign →	← heard that it's difficult to use

Which driving force do you think was identified by the team as being beyond their control?

- Provide training
- Provide facts and data through a PR campaign
- Upgrade incompatible hardware

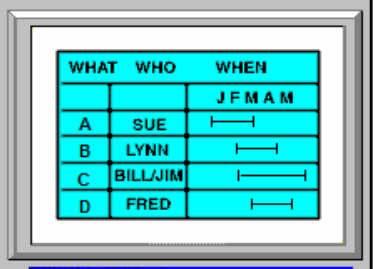
Click on your answer.

Replay

GANTT CHART

What is it?

A *GANTT CHART* is a diagram that documents the schedule, events, activities, and responsibilities necessary to complete a project or implement a group's proposed solution. The *GANTT CHART* can also allow a group to document the assumptions underlying their implementation plan. Based on these assumptions, the group can develop contingency plans in case the deadlines for implementation plan are not met.



Click on graphic to hear audio.

Click on the arrow(s) to see more.

RESULTS:

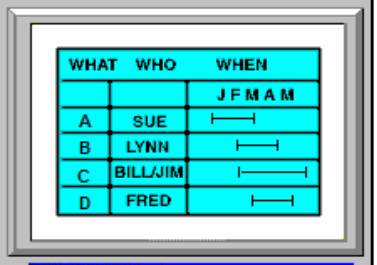
The team now has

- *a way to break the implementation plan into achievable steps*
- *a method to assign responsibility for each step to a group member*
- *a method to track how long each task will take*

GANTT CHART

What is it?

The *GANTT CHART* will have three sections to it. The first section will list the tasks to be completed. The second section will list the people responsible for each of the tasks. The third section will show the date each task is to be completed by.



Click on graphic to hear audio.

Click on the arrow(s) to see more.

RESULTS:

The team now has

- *a way to break the implementation plan into achievable steps*
- *a method to assign responsibility for each step to a group member*
- *a method to track how long each task will take*

GANTT CHART

When do I use it?

Document the steps.

A *GANTT CHART* can be used to document the steps needed, person(s) responsible, and deadlines to be met in order to fully implement a solution or complete a project.

Click on the situation you want to explore further.

GANTT CHART

How do I build it? Summary

Task	Who	When			
		3/8/95	3/15/95	3/22/95	3/29/95
Create Survey to obtain preferences	Bob & Sue	⊢			
Mail out Survey to employees	Bob & Sue	⊢			
Collect Survey from employees	Elaine		⊢		
Analyze results	Debbie			⊢	
Announce software to be purchased	Debbie			⊢	
Call software retailers to place order	Ken				⊢
Receive software material & load to PC's	Tom				⊢

Step 1: Set up the Gantt Chart into three columns and several rows.

Step 2: Label the first column "Task."

Step 3: Label the second column "Who."

Step 4: Label the third column "When."

Step 5: Break the implementation plan or project into achievable tasks and list the tasks in the rows of the first column.

Step 6: Assign responsibility for each task to a group member(s) and place their name(s) in the second column on the same line with that task.

Step 7: Decide how long each task will take and set a realistic completion date.

Step 8: Document the assumptions on which the plan is based, and the contingency plans to implement if those assumptions are not valid.

Done

GANTT CHART

Interpretation Question

Task	Who	When			
		3/8/95	3/15/95	3/22/95	3/29/95
Create Survey to obtain preferences	Bob & Sue	⊢			
Mail out Survey to employees	Bob & Sue	⊢			
Collect Survey from employees	Elaine		⊢		
Analyze results	Debbie			⊢	
Announce software to be purchased	Debbie			⊢	
Call software retailers to place order	Ken				⊢
Receive software material & load to PC's	Tom				⊢

Who is responsible for loading the software?

- Sue
- Tom
- Ken
- Elaine

Click on your answer.

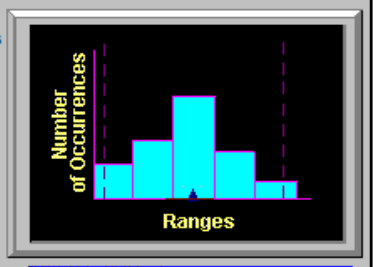
Replay

HISTOGRAM

What is it?

A *HISTOGRAM* is a picture of the variation in a process or process characteristic such as time, temperature, length, etc. It gives you an understanding of the data as a whole. It converts unorganized sets of data into a coherent picture.

The *HISTOGRAM* is based on the principle that repeated measurements tend to cluster around a central value and to taper off symmetrically on both sides.



Click on graphic.

Click on the arrow(s) to see more.

RESULTS:

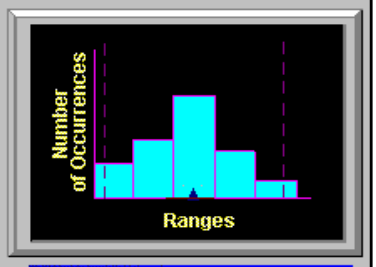
The team now has

- *evidence of the need for a problem solving or quality improvement team*
- *demonstrations of the variability of the data*

HISTOGRAM

What is it?

After data is plotted on the graph, the shape of the curve formed by the tops of the *HISTOGRAM's* bars shows the pattern, or "distribution" of the process data. Bell-shaped curves signify what is called a normal distribution of data. There are some process or data sets that do not have naturally normal distributions. Instead, the data is piled up on one end or the other. This is called a skewed distribution.



Click on graphic.

Click on the arrow(s) to see more.

RESULTS:

The team now has

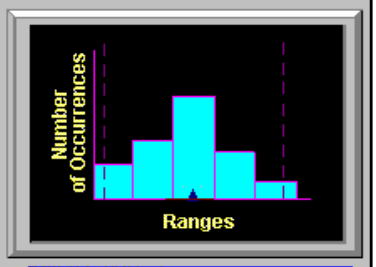
- *evidence of the need for a problem solving or quality improvement team*
- *demonstrations of the variability of the data*

HISTOGRAM

What is it?

A *HISTOGRAM* will tell you if your process is aligned with your target. This is done by checking to see if the curve peaks on the target value. If it's off target you would want to investigate further.

Variation is common to all processes. You can see how much your process is varying by checking the difference between the largest and smallest measurements on the *HISTOGRAM*. This is defined as the range.



Click on graphic.

Click on the arrow(s) to see more.

RESULTS:

The team now has

- *evidence of the need for a problem solving or quality improvement team*
- *demonstrations of the variability of the data*

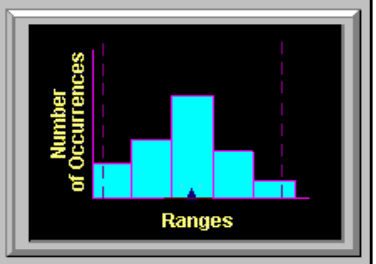
HISTOGRAM

What is it?

The *mode* is the most frequently observed value, class, interval, grouping, or data point.

The *median* is the midpoint in a distribution of scale. This is the point above and below which 50 percent of the data falls.

Add markings of the measures of central tendency to the *HISTOGRAM*. Be especially suspicious of your data if the tallest bar in your *HISTOGRAM* occurs on



Click on graphic.

Click on the arrow(s) to see more.

RESULTS:

The team now has

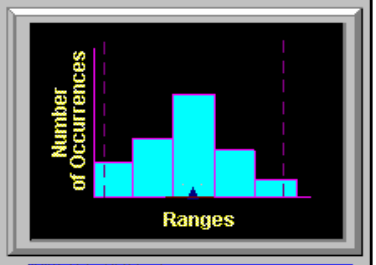
- *evidence of the need for a problem solving or quality improvement team*
- *demonstrations of the variability of the data*

HISTOGRAM

What is it?

the far left (positively skewed) or far right (negatively skewed).

A *HISTOGRAM* makes it possible to see at a glance if the range extends past your limits. If it does, this indicates that defective work is being produced.



Click on graphic.

Click on the arrow(s) to see more.

RESULTS:

The team now has

- *evidence of the need for a problem solving or quality improvement team*
- *demonstrations of the variability of the data*

HISTOGRAM

When do I use it?

Discover and display the distribution of data into categories.

See if a process is on target and within specification limits.

Show the comparative frequency of measurements in a way that is easy to see.

A *HISTOGRAM* takes a list, or table, of data points and arranges those points into categories. By looking at the shape formed by the tops of the bars, you get a snapshot view of the shape of the data distribution and variability of the data set.

Click on the situation you want to explore further.

HISTOGRAM

When do I use it?

Discover and display the distribution of data into categories.

See if a process is on target and within specification limits.

Show the comparative frequency of measurements in a way that is easy to see.

The shape formed by the tops of a *HISTOGRAM's* bars often gives an indication whether or not a process is on target. A process that is centered around the target value is said to be on target. You can check to see if the process is within specifications by drawing in the specification limits on the *HISTOGRAM* and observing the distribution.

Click on the situation you want to explore further.

HISTOGRAM

When do I use it?

Discover and display the distribution of data into categories.

See if a process is on target and within specification limits.

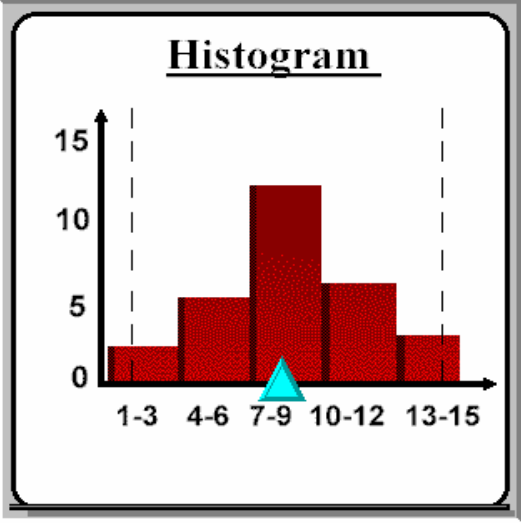
Show the comparative frequency of measurements in a way that is easy to see.

The *HISTOGRAM* is constructed so that the more frequent measurements have the tallest bars. It is easier to see which measurements are most frequently occuring by looking at a *HISTOGRAM* rather than a table of data.

Click on the situation you want to explore further.

HISTOGRAM

How do I build it? Summary



Step 1: Collect interval data based on the critical measurement you are trying to assess.

Step 2: Identify the difference between the smallest and largest data points (range). Decide the number of bars (cells) your Histogram will have (6-10) and divide the range by the number of bars (cells).

Step 3: Decide on the scale for the vertical axis.

Step 4: Draw each bar in place.

Step 5: Calculate the measures of central tendency: average, mode, and median.

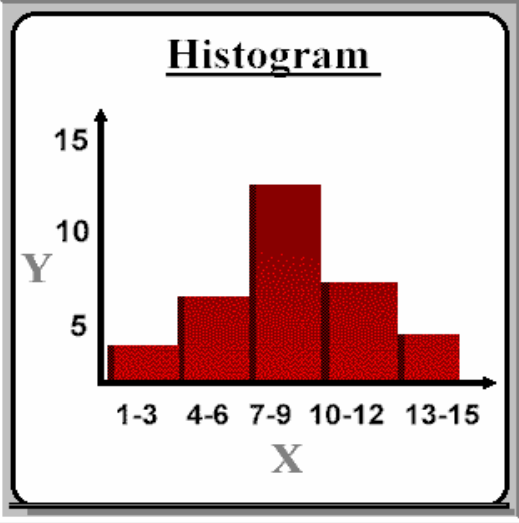
Step 6: Add the central tendency markings and specification limits to the Histogram.

Step 7: Look at the pattern of the bars. Determine if the pattern indicates a normal, skewed, or other distribution.

Done

HISTOGRAM

Interpretation Question



This histogram shows which type of pattern?

- skewed
- normal
- bimodal

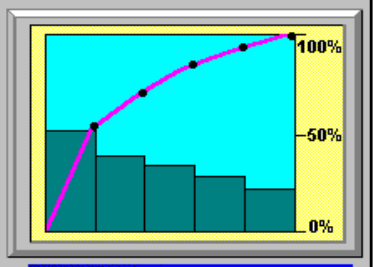
Click on your answer.

Replay

PARETO CHART

What is it?

A *PARETO CHART* is a vertical bar graph that displays categories of problems or causes in order of relative frequency. It is used to prioritize problem causes in order to separate the "vital few" from the "trivial many."



Click on graphic to hear audio.

RESULTS:

The team now has

- *categorization of data to identify improvement opportunities*
- *ranking of improvement opportunities to help set objectives*
- *focus on the 20 percent of the problems that may be causing 80 percent of the defects or costs (80/20 rule)*

PARETO CHART

When do I use it?

Decide what to work on first.

Display the relative importance of each problem, or cause, by frequency, cost, or time.

When a process seems to have so many problems or problem causes that it is not clear where to start to make improvements, a *PARETO CHART* can be a big help.

By working with the problems or causes that get the tallest bars on the chart, you can be sure that you are attacking the most frequent, or possibly costliest, problems.

Click on the situation you want to explore further.

PARETO CHART

When do I use it?

Decide what to work on first.

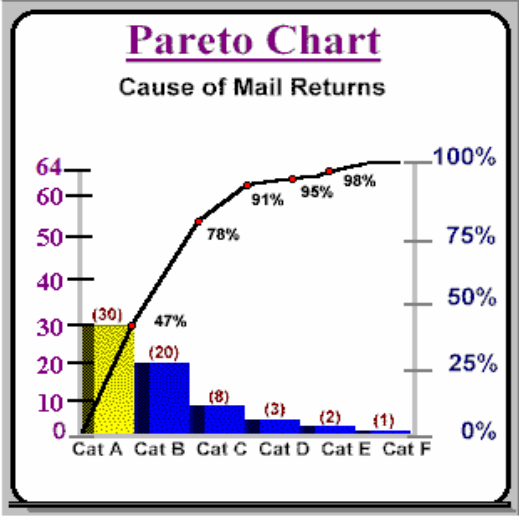
Display the relative importance of each problem, or cause, by frequency, cost, or time.

PARETO CHARTS can be constructed by frequency of problems or causes, by the cost of the problems or causes, or by the time associated with each problem or cause. It is usually helpful to do more than one analysis.

Click on the situation you want to explore further.

PARETO CHART

How do I build it? Summary



Step 1: Collect data, total the results, and arrange the totals in descending order.

Step 2: List the categories across the bottom of the chart from left to right (largest to smallest).

Step 3: Label the left side of the chart with the unit of frequency.

Step 4: Draw in the bars by category, from left to right. The height of each bar is determined by the corresponding value on the left vertical axis.

Step 5: Place a dot at the upper right point of the bar of the cumulative percent. Then go to the upper right corner of the second bar and place a dot at the number equal to the sum of the first and second bars.

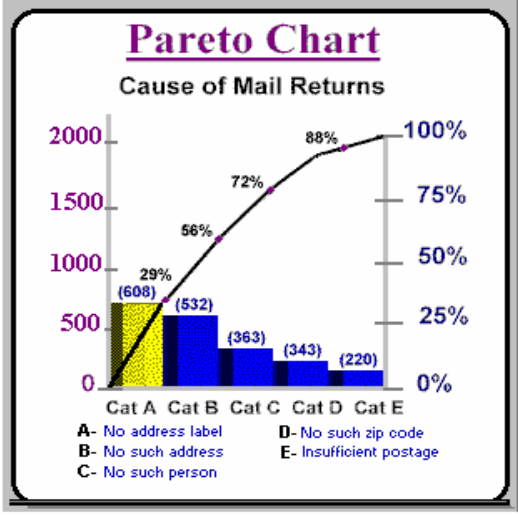
Step 6: Title the graph.

Step 7: Analyze the chart by seeing which bar is the tallest.

Done

PARETO CHART

Interpretation Question



Based on this Pareto Chart, which problem could you focus on solving first?

- Missing address labels
- Wrong addresses
- Insufficient postage

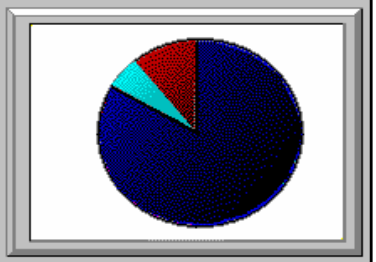
Click on your answer.

Replay

PIE CHART

What is it?

A *PIE CHART* is a visual display that shows the relationship of how each category contributes to the whole. *PIE CHARTS* are simple graphs in which the entire circle represents the complete data set (100%). The circle is divided into percentage "slices." Each slice represents one of the categories of data. The size of the slice is the proportional percentage of that category out of 100%.



Click on graphic to hear audio.

RESULTS:
The team now has

- *a way to show the relationship of each part of the whole*

PIE CHART

When do I use it?

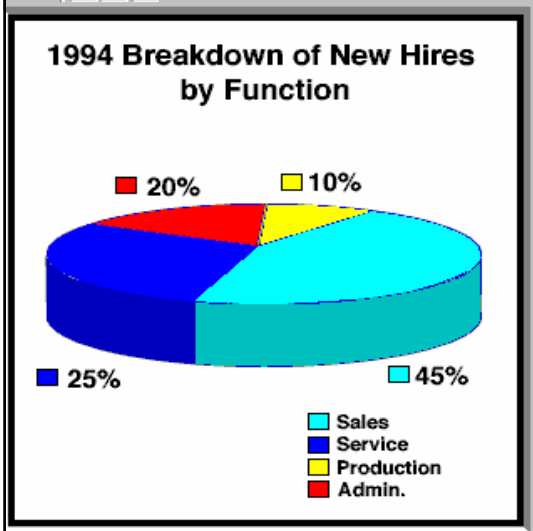
Easily compare categories.

PIE CHARTS are useful to use when one needs to effectively display and easily interpret the relationship of each category to not only the whole but to each other.

Click on the situation you want to explore further.

PIE CHART

How do I build it? Summary



Step 1: Determine the frequency of each category.

Step 2: Determine the percentage of each category by dividing the frequency of each category by the total sum of all categories.

Step 3: Divide the pie (circle) into "slices" representing each category The size of the "slice" is proportionate to each category's percentage of the whole.

Step 4: Shade each slice to help distinguish the different categories.

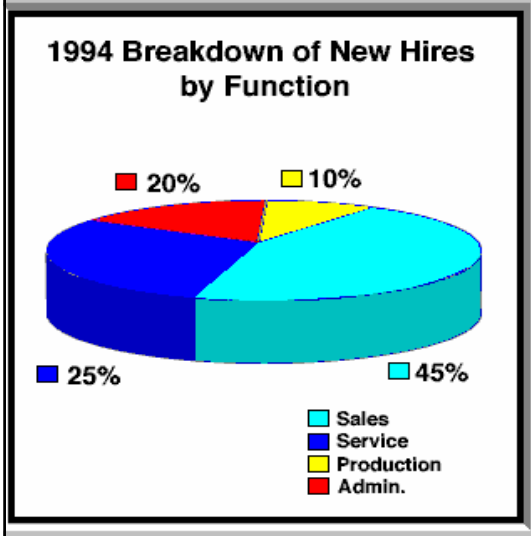
Step 5: Label everything clearly and include a legend to help further clarify the chart.

Step 6: Add a descriptive title to the chart.

Done

PIE CHART

Interpretation Question



Which type of position was filled the most in 1994 by the company?

- Service
- Production
- Sales
- Admin

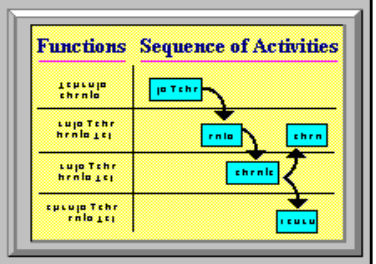
Click on your answer.

Replay

PROCESS MAP

What is it?

PROCESS MAPPING, also known as "Systems Chart", is a technique for examining a process to determine where and why major breakdowns occur. It provides you with a picture of the actual steps in a process. *PROCESS MAPPING* is the first step taken prior to evaluating a process and designing an improved one. Once the current process is understood, *PROCESS MAPPING* can also be used to map out a new, improved process.



Click on graphic to hear audio.

PROCESS MAPS differ from *Flowcharts* as they are used to show cross-functional processes, such as a new account process -- which requires input from Marketing, Credit Policy, Systems, Operations, and so on. By comparison, *Flowcharts* are used to diagram steps within a function or a specific process.

RESULTS:

The team now has

- *a graphic depiction of key business processes within an organizational system indicating major inputs, outputs, and individuals or departments involved*

PROCESS MAP

When do I use it?

Document how a process works.

Examine a process to determine where and why major break-downs and/or re-work occur.

PROCESS MAPPING forces you to document all steps of a business process. It allows you to get a clear understanding of how the business process works.

Click on the situation you want to explore further.

PROCESS MAP

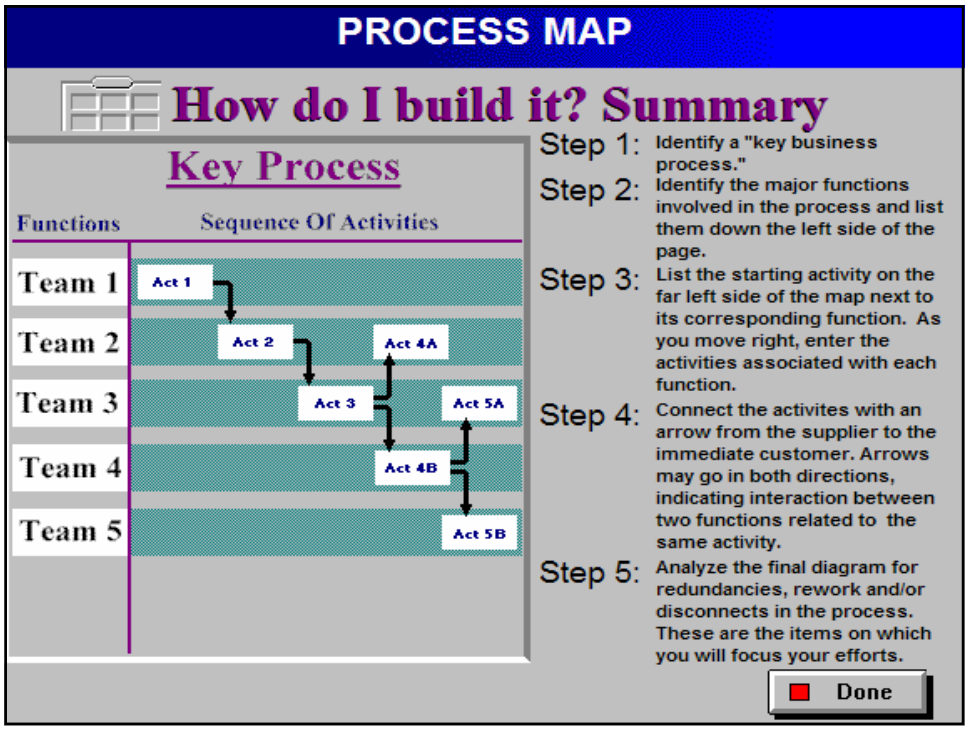
When do I use it?

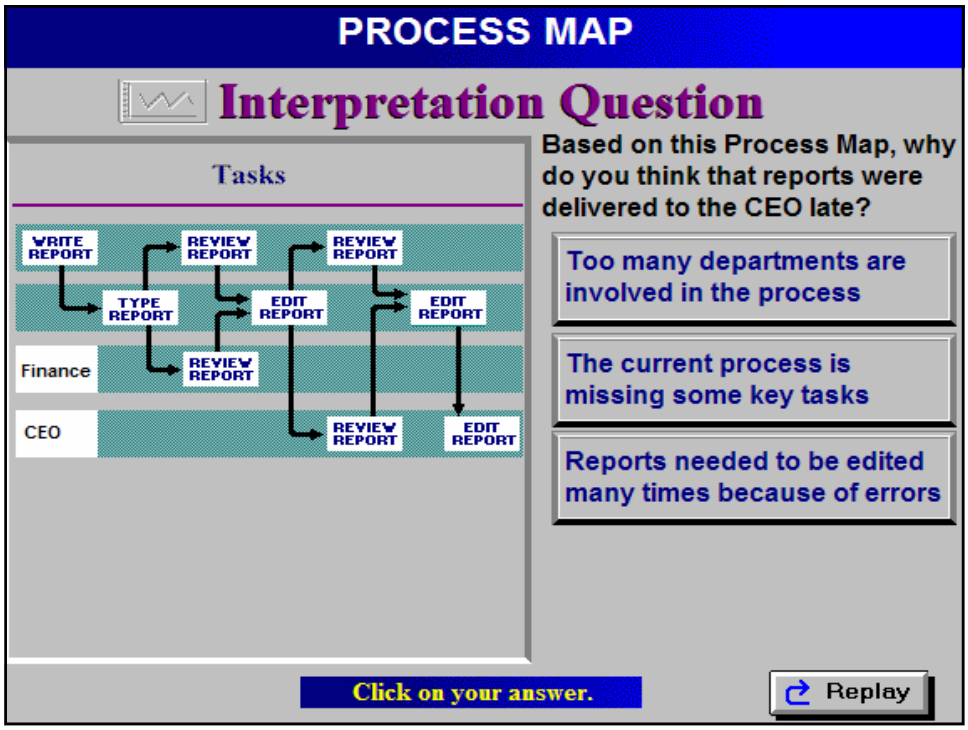
Document how a process works.

Examine a process to determine where and why major break-downs and/or re-work occur.

PROCESS MAPPING uncovers specific problems in the process, such as redundancy and re-work, so that selected improvements can be effectively targeted.

Click on the situation you want to explore further.


PROCESS MAP
How do I build it? Summary
Key Process
Functions
Sequence Of Activities
Team 1
Team 2
Team 3
Team 4
Team 5
Act 1
Act 2
Act 4A
Act 3
Act 5A
Act 4B
Act 5B
Step 1: Identify a "key business process."
Step 2: Identify the major functions involved in the process and list them down the left side of the page.
Step 3: List the starting activity on the far left side of the map next to its corresponding function. As you move right, enter the activities associated with each function.
Step 4: Connect the activites with an arrow from the supplier to the immediate customer. Arrows may go in both directions, indicating interaction between two functions related to the same activity.
Step 5: Analyze the final diagram for redundancies, rework and/or disconnects in the process. These are the items on which you will focus your efforts.
Done

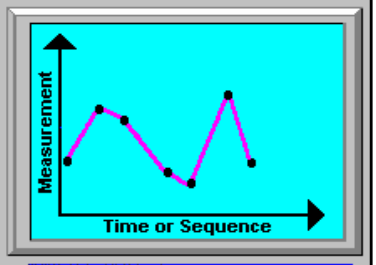

PROCESS MAP
Interpretation Question
Tasks
WRITE REPORT
REVIEW REPORT
REVIEW REPORT
TYPE REPORT
EDIT REPORT
EDIT REPORT
Finance
REVIEW REPORT
CEO
REVIEW REPORT
EDIT REPORT
Based on this Process Map, why do you think that reports were delivered to the CEO late?
Too many departments are involved in the process
The current process is missing some key tasks
Reports needed to be edited many times because of errors
Click on your answer.
Replay

RUN CHART

What is it?

Also called a "plotted line chart," the *RUN CHART* is used to track process performance over time.

By recording the data points in the order in which they occur, *RUN CHARTS* provide pictorial information about changes in a process.



Click on graphic to hear audio.

RESULTS:

The team now has

- *a display of observation points over a specified period of time*

RUN CHART

When do I use it?

Establish a baseline for improvement.

See what is happening in a process.

Analyze the effects of change you have made to a process.

A *RUN CHART* allows you to compare the historical performance of a process with the improved performance.

Click on the situation you want to explore further.

RUN CHART

When do I use it?

Establish a baseline for improvement.

See what is happening in a process.

Analyze the effects of change you have made to a process.

By tracking consecutive measurements of various process outputs on a *RUN CHART*, you get a picture of how those outputs vary over time.

Click on the situation you want to explore further.

RUN CHART

When do I use it?

Establish a baseline for improvement.

See what is happening in a process.

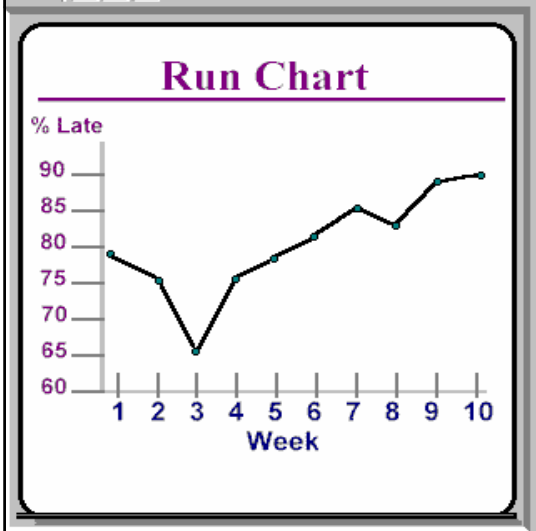
Analyze the effects of change you have made to a process.

When making changes to a process, it is important to observe and understand how the output has been affected by the changes you have made. Using "before" and "after" *RUN CHARTS* is a good way to do this.

Click on the situation you want to explore further.

RUN CHART

How do I build it? Summary



Step 1: Decide what to measure.

Step 2: Establish a timeframe of measurement.

Step 3: Draw the vertical axis on the left, which represents measured values. On the axis, indicate the number of expected occurrences; draw the scale accordingly.

Step 4: Draw the horizontal axis at the base, which represents time or sequence. Indicate time limits across the bottom.

Step 5: Plot each ordinal or interval data point on the chart as it occurs.

Step 6: Connect the data points.

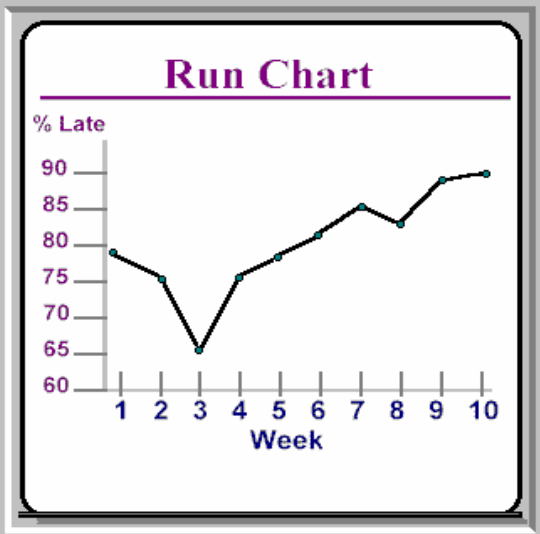
Step 7: Label and display the chart.

Step 8: Analyze the chart.

Done

RUN CHART

Example



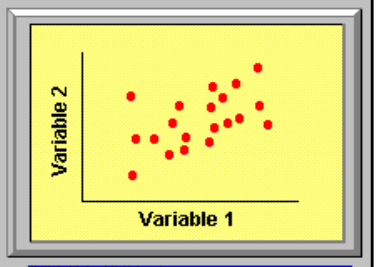
Replay

SCATTER DIAGRAM

What is it?

A *SCATTER DIAGRAM* is a graphic display illustrating what happens to one variable when another variable changes. Scatter Diagrams are also used to test for possible cause and effect relationships. It cannot prove that one variable causes the other, but it does make it clear whether a relationship exists and the strength of that relationship.

A *SCATTER DIAGRAM* is set up on a graph where the horizontal axis is X and the vertical axis is Y. Points are plotted on the graph using measurement values for two different variables. The plotted points on the graph form a pattern and it's this pattern that gives you a clue to the relationship of the variables.



Click on graphic to hear audio.

RESULTS:
The team now has

- *a way to analyze the data*
- *a way to validate suspected relationships*
- *assistance in verifying the root cause*

SCATTER DIAGRAM

When do I use it?

Display what happens to one variable when another variable changes.

Test a theory that two variables are related.

See whether a variable can be affected indirectly by controlling another variable.

Variables in processes are often correlated in some way. The *SCATTER DIAGRAM* is used to make it clear whether any correlations between variables exist.

Click on the situation you want to explore further.

SCATTER DIAGRAM

When do I use it?

Display what happens to one variable when another variable changes.

Test a theory that two variables are related.

See whether a variable can be affected indirectly by controlling another variable.

If you believe two variables are correlated, you can use a *SCATTER DIAGRAM* to test your theory. By plotting your data, you can see if any correlation patterns emerge.

Click on the situation you want to explore further.

SCATTER DIAGRAM

When do I use it?

Display what happens to one variable when another variable changes.

Test a theory that two variables are related.

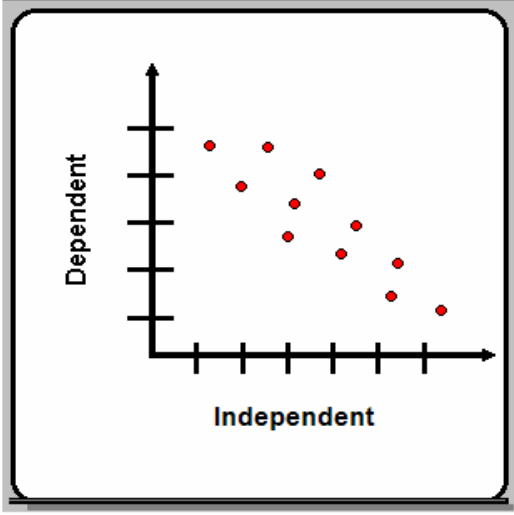
See whether a variable can be affected indirectly by controlling another variable.

Some variables are difficult to control directly. In such cases, you should look for another variable that is easier to control and that, in turn, affects the variable you need.

Click on the situation you want to explore further.

SCATTER DIAGRAM

How do I build it? Summary



Step 1: Collect paired samples of ordinal or interval data relationships and record them.

Step 2: Draw the horizontal and vertical axes of a graph.

Step 3: Label the variable you suspect as the independent variable on the horizontal axis and the variable you suspect as the dependent variable on the vertical axis.

Step 4: Plot the data on the graph.

Step 5: Look for positive, negative, or no relationship patterns.

Done

SCATTER DIAGRAM

Interpretation Question

The scatter diagram shows which one of the following patterns?

- positive pattern
- negative pattern
- no relationship between the two variables

Click on your answer.

Replay

"THREE ACTUAL" RULE

What is it?

The *"THREE ACTUAL" RULE* is a guideline for verifying that decisions are based on facts.

Click on graphic to hear audio.

RESULTS:
The team now has • *a reality test*

"THREE ACTUAL" RULE

When do I use it?

Understand the problem before going forward.

Track the real effect that an improvement is having.

The *"THREE ACTUAL" RULE* requires you to collect data from the right sources before trying to solve a problem.

Click on the situation you want to explore further.

"THREE ACTUAL" RULE

When do I use it?

Understand the problem before going forward.

Track the real effect that an improvement is having.

By using the *"THREE ACTUAL" RULE*, you will validate your understanding of the effect that a change is having on the initial problem.

Click on the situation you want to explore further.

"THREE ACTUAL" RULE

How do I build it?

Step 1: Go to the actual place.

Step 2: See the actual problem.

Step 3: Talk to the actual people involved and get the facts.

WEIGHTED VOTING

What is it?

WEIGHTED VOTING is a way to qualify the positions and preferences of the group members usually after a brainstorming session. The group is given a number of votes which they can distribute among various options. There are no decision factors or criteria used and there is no discussion or effort to reach agreement on a single number. It gives the group information about where individual members stand and how strong their opinions are. This information will help make it easier for opposing viewpoints to surface.

	A	B	C	D
Dad	1	2	2	1
Mom	1	0	1	4
Tom	3	1	1	1
Sue	4	1	1	0
Joe	1	1	1	3

A: Pool
B: Hike
C: Beach
D: Movies

Click on graphic to hear audio.

Click on the arrow(s) to see more.

RESULTS:

The team now has

- *a better understanding of the personal opinions about each item*
- *a shorter list for further evaluation*

WEIGHTED VOTING

What is it?

Consensus can't be reached without dealing with those viewpoints. Often, based on the discussion, the list can be narrowed to a more manageable few items (usually three to five).

	A	B	C	D
Dad	1	2	2	1
Mom	1	0	1	4
Tom	3	1	1	1
Sue	4	1	1	0
Joe	1	1	1	3

A: Pool
B: Hike
C: Beach
D: Movies

Click on graphic to hear audio.

Click on the arrow(s) to see more.

RESULTS:

The team now has

- *a better understanding of the personal opinions about each item*
- *a shorter list for further evaluation*

WEIGHTED VOTING

When do I use it?

Allow a group to cooperatively prioritize items.

Reduce a larger list to a smaller list.

WEIGHTED VOTING is useful for "taking the temperature" of the group as it is working towards reaching consensus on the options. Everyone has an equal opportunity to participate and express their opinions regarding each item.

Click on the situation you want to explore further.

WEIGHTED VOTING

When do I use it?

Allow a group to cooperatively prioritize items.

Reduce a larger list to a smaller list.

WEIGHTED VOTING allows team members to take a long list of ideas generated (i.e., a brainstormed list) and then possibly narrow the list down by voting on each item. *WEIGHTED VOTNG* does not make decisions, however, it provides a way for team members to express their preferences. Once the discussion has taken place, the team may feel that certain items no longer need to be considered. These items are then removed from the list.

Click on the situation you want to explore further.

WEIGHTED VOTING

How do I build it? Summary

	A	B	C	D	E
Jim	1	2	1	3	1
Alice	1	3	1	2	1
Jack	2	2	1	2	1
Marilyn	1	2	2	1	2
Bob	1	3	1	3	0

Step 1: Set up a grid -- group members' names on the rows and the options (usually lettered A to Z, for convenience) at the column headings.

Step 2: Give each member a number of votes to distribute according to their preferences. As a rule of thumb, the number of votes each member gets should be 1.5 times the number of options. Have the group members decide how they will spread out their votes before any votes are recorded on the grid.

Step 3: Record the members' votes on the grid by option, not by person.

Step 4: Review the results and reach consensus if the list needs to be narrowed down further.

NOTE: A Decision Matrix may be used if the list needs to be narrowed down further.

Done

WEIGHTED VOTING

Interpretation Question

	A	B	C	D	E	F	G	H	I	J	K
Jim	1	4	0	2	3	1	1	1	2	1	1
Alice	2	2	1	3	2	1	1	1	2	1	1
Jack	0	3	1	3	2	1	1	2	2	1	1
Marilyn	0	4	2	4	2	1	0	1	1	1	1
Bob	1	3	1	2	3	1	0	1	2	2	1

Which problem was identified as being potentially the most important?

- Problem A
- Problem B
- Problem C

Click on your answer.

Replay