E-PME Enlisted PROFESSIONAL MILITARY EDUCATION

Analytical Tools 17-9.01-K

COMPREHEND the best of the analytical tools for understanding data, as presented in the E-PME Study Guide.

Analytical Tools

In your position, you'll see a lot of different types of data cross your desk. Some of this data will be in context, and you'll be able to make sense of it. Other data may require you to use analytical tools to understand their impact.

These tools include:

- Flowcharting
- Cause and effect diagram
- Pareto chart
- Run chart

Flowcharting

A flowchart is a graphic representation of the major steps of a process. You can use a flowchart to:

- Understand the complete process
- Identify the critical stages of a process
- Locate problem areas
- Show relationships between different steps in a process

Flowcharting (continued)

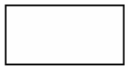
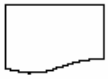
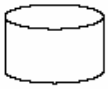
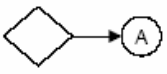
Instructions for creating a flowchart:

How To Do It:

1. **Identify the process.** Define the start point and finish point for the process to be examined.
2. **Describe the current process.** Chart the whole process (i.e., lay out all the steps) from beginning to end.
3. **Chart the ideal process (optional step).** Try to identify the easiest and most efficient way to go from the "start block" to the "finish block". While this step is not absolutely necessary, it does make it easier to do the next step.
4. **Search for improvement opportunities.** Identify all the areas that hinder your process or add little or no value. If you did the optional step, examine all areas that differ from your ideal process and question why they exist.
5. **Update your chart.** Build a new flowchart that corrects the problems you identified in the previous step.

Helpful Hint: You can put the steps of your process on index cards or sticky-back notes. This lets you rearrange the diagram without erasing and redrawing and prevents ideas from being discarded simply because it is too much work to redraw the diagram.

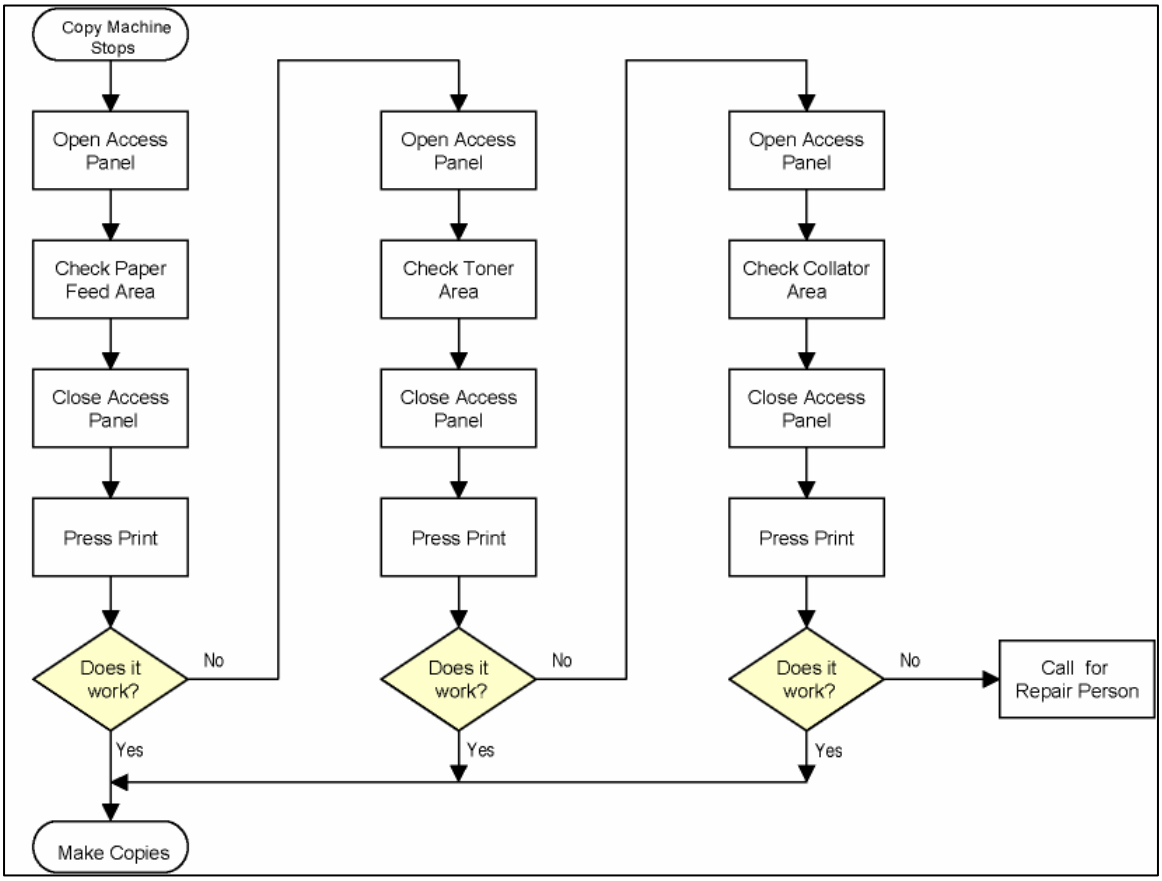
Standard flowchart symbols:

SYMBOL	REPRESENTS	EXAMPLES
	Start / Stop	Receive trouble report Receive input from supplier
	Decision point	Approve / Disapprove Accept / Reject Yes / No
	Activity	Drop off travel pouch Open access panel
	Document	Fill out trouble report
	Database	Snapshot or CEDS
	Connector to another page or part of flowchart	

A sample flowchart is provided on the following page.

Flowcharting (continued)

Example of a flowchart:



Cause and Effect Diagram

A cause and effect diagram graphically illustrates the relationship between a given outcome and all the factors that influence this outcome. Sometimes called an Ishikawa or "fishbone" diagram, this tool helps show the relationship of the parts (and sub-parts) to the whole by:

- Determining the factors that cause a positive or negative outcome (or effect)
- Focusing on a specific issue without resorting to complaints and irrelevant discussion
- Determining the root causes of a given effect
- Identifying areas where there may be a lack of data.

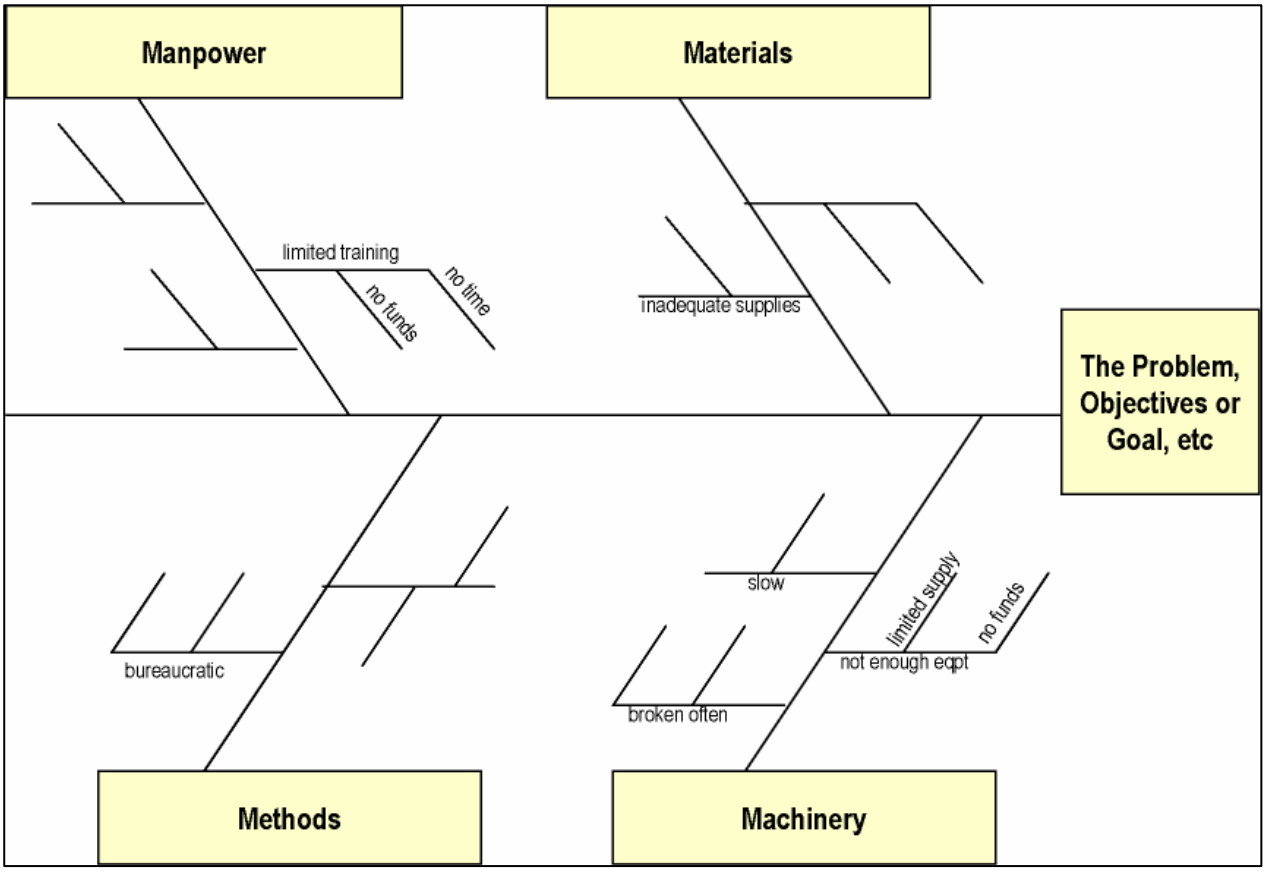
Instructions for creating a Cause and Effect diagram are provided on the following page.

Cause and Effect Diagram (continued)

How To Do It:

1. **Specify the effect to be analyzed.** The effect can be positive (objectives) or negative (problems). Place it in a box on the right side of the diagram.
2. **List the major categories of the factors that influence the effect being studied.** The "4 M's" (methods, manpower, materials, machinery) or the "4 P's" (policies, procedures, people, plant) are commonly used as as starting point.
3. **Identify factors and subfactors.** Use an idea generating technique to identify the factors and subfactors within each major category. An easy way to begin is to use themajor categories as a catalyst. For example, "What policies are causing ....." or "What procedures are causing ..... " or "How do our people influence ..... " or "How does our equipment affect ...."
4. **Identify significant factors.** Look for factors that appear repeatedly and list them. Also, list those factors that have a significant affect, based on the data available.
5. **Categorize and prioritize your list.** Keep in mind that the location of a cause in your diagram is not an indicator of its importance. A sub-factor may be the root cause to all of your problems. You may also decide to collect more data on a factor that had not been previously identified.

Example of a partially completed Cause and Effect diagram:



Pareto Chart

Pareto charts graphically represent data for easier interpretation than is found in raw numbers. They are bar charts used to separate the vital few from the trivial many.

These charts are based on the Pareto Principle, which states that 20 percent of the problems have 80 percent of the impact. The 20 percent of the problems are the vital few; the remaining problems are the trivial many.

You can use the Pareto chart to:

- Separate the few major problems from the many possible problems to provide focus on your improvement efforts
- Arrange data according to priority or importance
- Determine which problems are most important, using data not perceptions

***Instructions for creating a Pareto chart*:**

How To Do It:

1. **Use existing measurement plans or collect new data on the process.** Be sure the units of measure are consistent throughout your data. Select attributes to be charted so that any given occurrence will fall into one and only one category. Checksheets are great sources of data for building a Pareto.
2. **Label the chart.** Label the units of measure on the left vertical axis and the categories of problems on the horizontal axis. (Optional) You can use the right vertical axis to measure the percentage of total occurrences contained within each category.
3. **Plot the data.** Order the categories according to their frequency, not their classification. Use a descending order from left to right. Categories that appear infrequently, or in comparatively small numbers, can be grouped together in an "other" category.
4. **Points to Remember:**
   - The measurement units can significantly affect your Pareto chart. You must determine whether cost or number of occurrences is more important.
   - It is essential to use the same units of measure and clearly mark these units on the chart ($, #, %, etc.)
   - Make sure that the "other" category does not become unreasonable large. If the "other" category accounts for more than 25% of your problem, you probably should try to break it down.
   - Pareto Charts read from left to right, in descending order to highlight the significant areas.

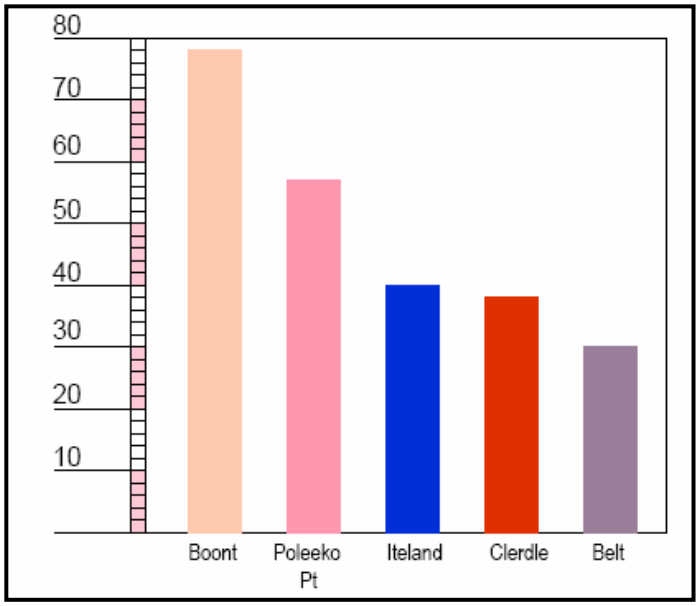
Pareto Chart Example:

Headquarters had received feedback concerning the need for additional resources in several geographical areas. A team has collected data on five locations and their workload. The checksheet on the following page shows a week's worth of boardings.

Pareto Chart (continued)

Station	BWI	Unsafe Operations	No Survival Equipment	Unseaworthy Vessels	Totals
Poleeko Pt	2	16	19	20	57
Boont Bay	3	19	33	23	78
Iteland Island	1	7	9	23	40
Belt Bay	1	8	17	4	30
Clerdle Cove	0	9	16	13	38
Totals	7	59	94	83	243

The Pareto chart can be based either on the number of occurrences by station, by the type of case or cost of responding. This Pareto example is based on the **number of occurrences by station**.



Progressive Analysis takes one of the categories for the Pareto and breaks it down into subparts progressing from general classification to the specific. It is used when the category has many subparts to it that might be affecting it. The resulting bar graph is a Pareto Chart, which can then be broken down even further.

Run Chart

A Run chart is a graph that shows the changes in a process measurement over time. You can use a run chart to:

- Recognize patterns of performance in a process
- Document changes over time

Instructions for creating a Run chart:

How To Do It:

1. Construct the chart. Label the vertical axis with the key measurement of the process being measured.
2. Collect the data. Collect data for an appropriate number of time periods, in accordance with your data collection strategy.
3. Plot the data. Plot each data point on the chart. Calculate and plot the average. This provides a reference for drawing conclusions about the individual data points.
4. Interpret the chart. Interpret the chart using your knowledge of the process. Some possible signals that the process has significantly changed are:
   - Six points in a row that steadily increase or decrease
   - Nine points in a row that are on the same side of the average
   - Other patterns to for include significant shifts in levels, cyclical patterns and bunching of data points
5. Repeat. Compute the average for subsequent blocs of time, or after a significant change has occurred.

Example Run Chart:

This Run Chart shows how many minutes it took the crewmembers to get the boat underway after the SAR alarm had sounded.