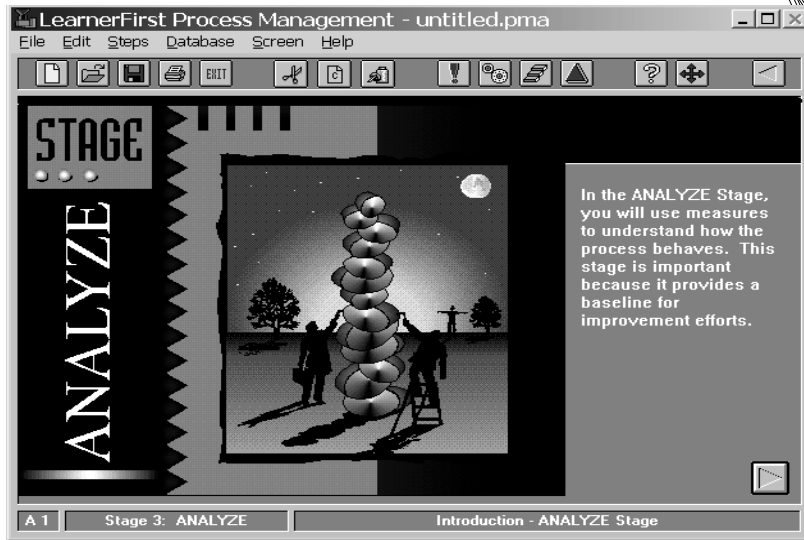


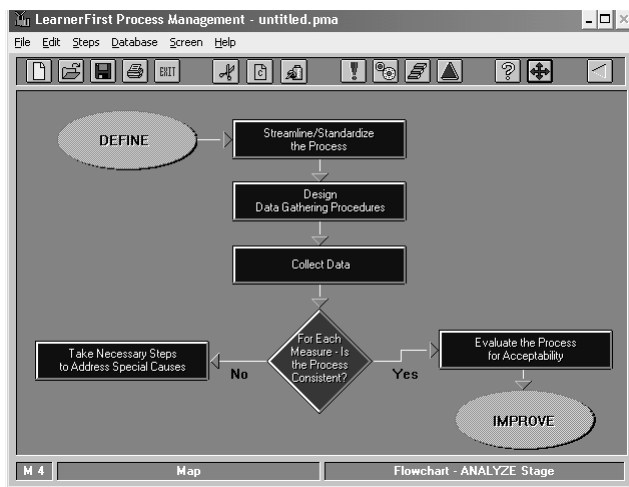
# step 3



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# Analyze



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**Introduction - ANALYZE Stage**

In this stage, you will look at the process objectively and statistically. Any decisions to change will be based on data, not feel. ANALYZE consists of six steps. Begin with the "Streamline/Standardize the Process."

- Streamline/Standardize the Process
- Design Data Gathering Procedures
- Collect Data
- Determine Consistency
- Address Special Causes
- Evaluate Acceptability

A 2 Stage 3: ANALYZE Introduction - ANALYZE Stage

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**LearnerFirst Process Management - untitled.pma**  
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**Streamline/Standardize the Process**

What is this step?  
 In this step, you will analyze and simplify the process.

Why is this step done?  
 Make obvious improvements and avoid improving activities that are better eliminated.

A 3 Stage 3: ANALYZE Streamline/Standardize the Process - Introduction

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 File Edit Steps Database Screen Help

**Identify Opportunities**

▶ As you read and respond to the questions, look for opportunities to smooth the flow of work, information, paper, products, etc. Reviewing a flowchart of the process might reveal obvious candidates.

◀◀ 1 of 7 ▶▶

**Is there duplication of effort? What is the logic behind the apparent duplication? Ask yourself - Why is this being done? Is this really necessary? Can it be eliminated or combined with another activity?**

▶

A 4 Stage 3: ANALYZE Streamline the Process - Identify Opportunities

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 File Edit Steps Database Screen Help

**Identify Opportunities**

▶ As you read and respond to the questions, look for opportunities to smooth the flow of work, information, paper, products, etc. Reviewing a flowchart of the process might reveal obvious candidates.

◀◀ 2 of 7 ▶▶

**Are there situations where work processes require that people refer to numerous sources of information to assemble what they need? Challenge the need to move, transport, or store. Ask yourself - Why do we save this, just in case? Why do we move this, can't it be done here?**

▶

A 4 Stage 3: ANALYZE Streamline the Process - Identify Opportunities

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The screenshot shows a software window titled "LearnerFirst Process Management - untitled.pma". The menu bar includes "File", "Edit", "Steps", "Database", "Screen", and "Help". The toolbar contains icons for file operations, navigation, and help. The main content area is titled "Identify Opportunities" and contains the following text: "As you read and respond to the questions, look for opportunities to smooth the flow of work, information, paper, products, etc. Reviewing a flowchart of the process might reveal obvious candidates." Below this is a navigation bar showing "3 of 7" with left and right arrows. The question text is: "Are there frequent quality checks or inspections? If checks are necessary, why are mistakes made in the first place?" There is a large empty text box for the user's response, with a pencil icon on the left. At the bottom, a status bar shows "A 4", "Stage 3: ANALYZE", and "Streamline the Process - Identify Opportunities". A hand-drawn pencil and wavy line are on the right side of the slide.

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The screenshot shows the same software window as slide 95. The navigation bar now shows "4 of 7". The question text is: "Are there unclear requirements? What can you do to clarify the requirements?" The rest of the interface, including the title, menu bar, toolbar, and status bar, is identical to the previous slide. A hand-drawn pencil and wavy line are on the right side of the slide.

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LearnerFirst Process Management - untitled.pma

File Edit Steps Database Screen Help

### Identify Opportunities

▶ As you read and respond to the questions, look for opportunities to smooth the flow of work, information, paper, products, etc. Reviewing a flowchart of the process might reveal obvious candidates.

5 of 7

Is there work that is confusing or complicated? What can be done to simplify the process? If people have to refer to bulky documentation to find answers to their questions, is there a way to simplify, summarize, or organize the information so it is more accessible?

A 4 Stage 3: ANALYZE Streamline the Process - Identify Opportunities

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LearnerFirst Process Management - untitled.pma

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### Identify Opportunities

▶ As you read and respond to the questions, look for opportunities to smooth the flow of work, information, paper, products, etc. Reviewing a flowchart of the process might reveal obvious candidates.

6 of 7

Is there work that is done at the last minute?

A 4 Stage 3: ANALYZE Streamline the Process - Identify Opportunities

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**Identify Opportunities**

As you read and respond to the questions, look for opportunities to smooth the flow of work, information, paper, products, etc. Reviewing a flowchart of the process might reveal obvious candidates.

7 of 7

Is there work that has to be done over? Identify the rework loop.

A 4 Stage 3: ANALYZE Streamline the Process - Identify Opportunities

**Streamline the Process - Value Added Assessment**

All activities in a process can be categorized into one of three categories: value added, non-value added/essential, or non-value added/non-essential. Each activity that you identified will be shown below one at a time. Please choose a category for each activity.

0 of 0

Activity

Value Added Our customers pay us to do this.

Non-value added/Essential This is not of value to the customer but is essential to conduct our business.

Non-value added/Non-essential This is of no value to our customers or our business. Examples: storing, waiting, checking, and approving.

A 5 Stage 3: ANALYZE Streamline the Process - Value Added Assessment

**LearnerFirst Process Management - untitled.pma**  
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**Value-Added Assessment**

Based on your responses in the previous screen, below are lists of the non-value added/essential and non-value added/non-essential

For these non-value added/essential activities, try to minimize their use.

For these non-value added/non-essential activities, try to

A 6 Stage 3: ANALYZE Streamline the Process - Value Added Assessment

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 File Edit Steps Database Screen Help

**Value-Added Assessment**

Usually, people concentrate on waste that is highly visible (material scrap, rework, etc.) and easily traced to the bottom line. However, one of the biggest sources of waste in any organization is inefficient use of time. In process management, a basic premise is that "time is money." Cycle time is a key measure of process efficiency.

Activity

Time required for the work in this activity to be performed (process time)?

Total throughput time (cycle time)?

Value added Ratio (Process Time/Cycle Time)

Work to increase this ratio to 100%  %

A 7 Stage 3: ANALYZE Streamline the Process - Value Added Assessment

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The screenshot shows a software window titled "LearnerFirst Process Management - untitled.pma". The menu bar includes "File", "Edit", "Steps", "Database", "Screen", and "Help". The toolbar contains icons for file operations, a printer, a warning sign, a help icon, and navigation arrows. The main content area features a slide with the following text:

**Streamline/Standardize the Process - Error Proof**

When you standardize the process, build in procedures that make it hard to create errors. Examples of error proofing are: spell checking, color coding, bar code scanning, last number redial, cross-checking math, automating repetitive activities.

What could go wrong and how can you error proof it? Please make a note of the ways that you can error proof the process.

Below the text is a large empty text box with a pencil icon on the left and a right-pointing arrow on the bottom right. The status bar at the bottom shows "A 8", "Stage 3: ANALYZE", and "Streamline/Standardize the Process - Error Proof".

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The screenshot shows a software window titled "LearnerFirst Process Management - untitled.pma". The menu bar includes "File", "Edit", "Steps", "Database", "Screen", and "Help". The toolbar contains icons for file operations, a printer, a warning sign, a help icon, and navigation arrows. The main content area features a slide with the following text:

**Streamline the Process - Manage Bottlenecks**

Bottlenecks are process activities that constrain all the others; they are the weakest link in the chain.

Do you have any bottlenecks? What are the sources of the bottlenecks? Look for long delays between process activities, people waiting on other people, idle time, "feast or famine" cycles, or high levels of "work-in-process" inventory.

Manage bottlenecks by:

- Balancing workloads more effectively.
- Cross training for flexibility.
- Reducing set-up times.
- Changing the sequence of process activities.
- Planning to change.
- Monitoring cycle periods.
- Conducting a routine process effectiveness audit.

Below the text is a right-pointing arrow. The status bar at the bottom shows "A 9", "Stage 3: ANALYZE", and "Streamline the Process - Manage Bottlenecks".

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The screenshot shows a software window titled "LearnerFirst Process Management - untitled.pma". The menu bar includes "File", "Edit", "Steps", "Database", "Screen", and "Help". The toolbar contains icons for file operations, navigation, and help. The main content area is titled "Pursue Invisible Waste" and contains the text: "Pursuing invisible waste is broad in scope and is a long-term activity. It represents subtle, minor changes of an evolutionary nature." Below this is a slide indicator "1 of 4" and a question: "Ask 'why?' does this process exist? Should it be reengineered out?". A text input field with a pencil icon is positioned below the question. The status bar at the bottom shows "A 10", "Stage 3: ANALYZE", and "Streamline the Process - Pursue Invisible Waste".

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The screenshot shows the same software window as above, but the slide indicator now shows "2 of 4" and the question is: "Ask 'why' does this cost exist?". The text input field with the pencil icon is still present below the question. The status bar at the bottom remains the same: "A 10", "Stage 3: ANALYZE", and "Streamline the Process - Pursue Invisible Waste".

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The screenshot shows a software window titled "LearnerFirst Process Management - untitled.pma". The menu bar includes "File", "Edit", "Steps", "Database", "Screen", and "Help". The toolbar contains icons for file operations, navigation, and help. The main content area is titled "Pursue Invisible Waste" and contains the text: "Pursuing invisible waste is broad in scope and is a long-term activity. It represents subtle, minor changes of an evolutionary nature." Below this is a navigation bar showing "3 of 4" slides. The current slide asks "Ask 'is the process too costly?'" and features a large empty text box with a pencil icon on the left. The status bar at the bottom indicates "A 10", "Stage 3: ANALYZE", and "Streamline the Process - Pursue Invisible Waste".

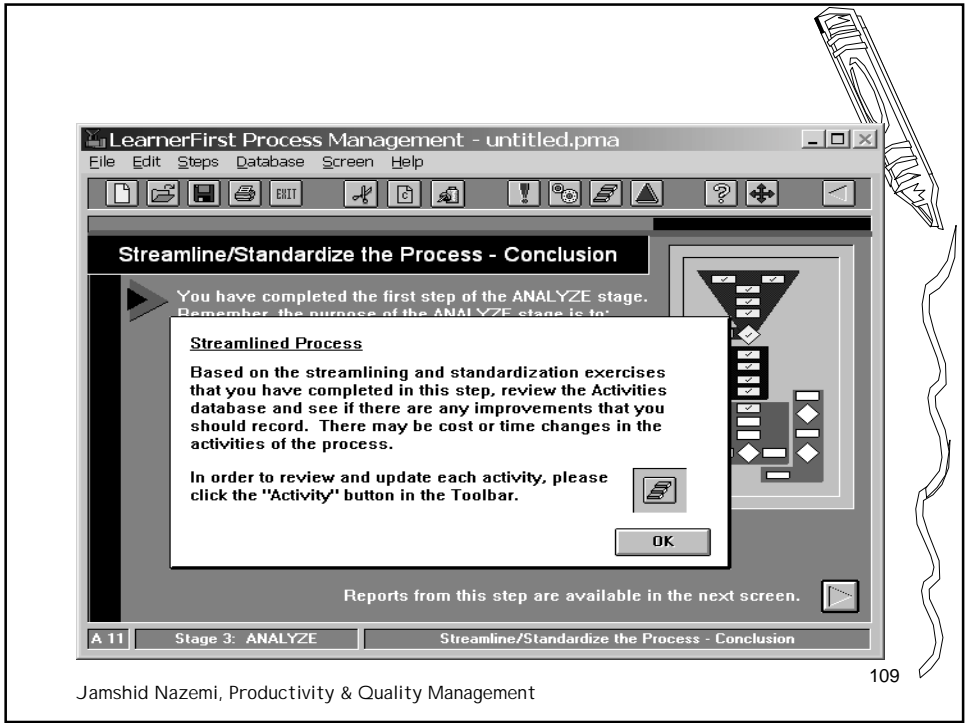
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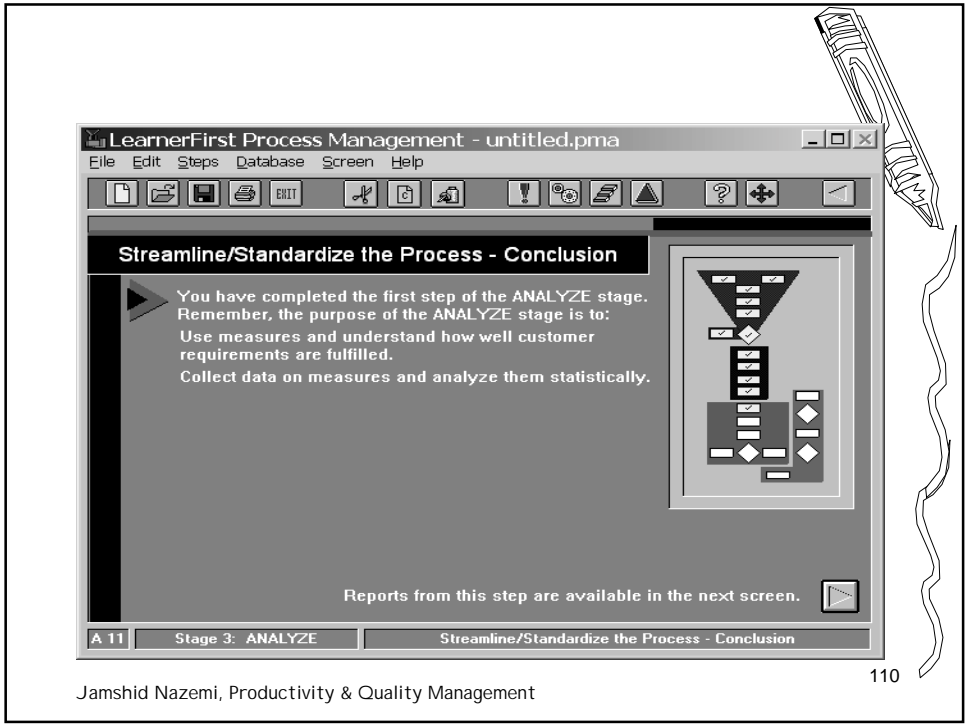
The screenshot shows the same software window as above, but now displaying slide 4 of 4. The main content area still has the title "Pursue Invisible Waste" and the introductory text. The navigation bar now shows "4 of 4" slides. The current slide asks "Ask 'does the process need redesign?'" and features a large empty text box with a pencil icon on the left. The status bar at the bottom remains the same, showing "A 10", "Stage 3: ANALYZE", and "Streamline the Process - Pursue Invisible Waste".

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**LearnerFirst Process Management - untitled.pma**  
File Edit Steps Database Screen Help

**Streamline/Standardize the Process - Conclusion**

There are three reports available from this step.  
Please click the appropriate button below.

Before moving on to the next step in Process Management, you should review what has been accomplished up to this point (on the following screen).

A 12    Stage 3: ANALYZE    Streamline/Standardize the Process - Conclusion

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Identified Opportunities  
Process:

There are probably many opportunities to smooth the flow of work, information, paper, products, etc. Reviewing a flowchart of the process might reveal obvious candidates.

Q. Is there duplication of effort? What is the logic behind the apparent duplication? Ask yourself - Why is this being done? Is this really necessary? Can it be eliminated or combined with another activity?

A.

Q. Are there situations where work processes require that people refer to numerous sources of information to assemble what they need? Challenge the need to move, transport, or store. Ask yourself - Why do we save this, just in case? Why do we move this, can't it be done here?

A.

Q. Are there frequent quality checks or inspections? If checks are necessary, why are mistakes made in the first place?

A.

Q. Are there unclear requirements? What can you do to clarify the requirements?

A.

Q. Is there work that is confusing or complicated? What can be done to simplify the process? If people have to refer to bulky documentation to find answers to their questions, is there a way to simplify, summarize, or organize the information so it is more accessible?

A.

Q. Is there work that is done at the last minute?

A.

Q. Is there work that has to be done over? Identify the rework loop.

A.

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### Value-Added Assessment

Value-Added Assessment: All activities in a process can be categorized into one of three categories: value added, non-value added/essential, or non-value added/non-essential. If value-added, then your customers pay you to do this. If non-value added/essential, then this activity is not of value to the customer but is essential to conduct your business. If non-value added/non-essential, then this activity is of no value to your customers or your business.

Activity Name:

Process Time:

Cycle Time:

Process time/ Cycle time: %

Value Assessment:



### Error Proof, Invisible Waste

Process:

Error Proof - Build in procedures that make it hard to create errors. Pursue

Invisible Waste - Pursuing invisible waste

is broad in scope and is a long-term activity. It represents subtle, minor changes of an evolutionary nature.

Error Proof:

Invisible Waste:

Q. Ask "why?" does this process exist? Should it be reengineered out?

A.

Q. Ask "why" does this cost exist?

A.

Q. Ask "is the process too costly?"

A.

Q. Ask "does the process need redesign?"

A.



**LearnerFirst Process Management - untitled.pma**  
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**Streamline/Standardize the Process - Recap**

The following checklist will help ensure that your objectives are clear prior to moving into data collection and analysis.

- Focused on customer satisfaction issues.
- Prioritized/aligned issues.
- Selected a target process based on your priorities.
- Defined the process (flowcharts, etc.).
- Identified and reconciled customer requirements for the output(s) of the process.
- Identified and reconciled supplier requirements for the input(s) of the process.
- Identified and reconciled standards for the supplier requirements.
- Identified and reconciled standards for the customer requirements.
- Developed measures to determine if the standards, with respect to customer and supplier requirements for the process, are being met.
- Completed value-added assessment of the steps (inputs) to the
- Possibly streamlined the process by "fixing the obvious," etc.

A 13 Stage 3: ANALYZE Streamline/Standardize the Process - Recap

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 File Edit Steps Database Screen Help

**Design Data Gathering Procedures**

**What is this step?**

In this step, you will determine when, where, and how data should be collected in the process.

**Why is this step done?**

Collect data that will be useful and will lend itself to meaningful analysis and evaluation.  
 Ensure that the data will be collected in an efficient and effective manner.  
 Improve your understanding of process behavior.

A 14 Stage 3: ANALYZE Design Data Gathering Procedures - Introduction

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**LearnerFirst Process Management - untitled.pma**  
File Edit Steps Database Screen Help

**Design Data Gathering Procedures**

It is helpful to follow these steps when designing a data collection plan. Begin with "Determine What You Want to Know."

- Determine What You Want to Know**
- Reflect on What You Already Know**
- Consider the Practical Aspects of Data Collection**
- Determine the Data Collection Plan**

Note: Most people assume an answer based upon their prior knowledge and experience about the process. Collecting data that is biased to confirm such assumptions is a waste of time.

A 15 Stage 3: ANALYZE Design Data Gathering Procedures

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**Design Data Gathering - Determine What You Want to Know**

Taking into account the work you have previously done in the FOCUS and DEFINE stages, ask "What do we want to know or learn about the process under study?". Consider these possibilities:

- \* to know whether or not the process is consistent (predictable)
- \* to know how the process performs relative to supplier and customer requirements (does the process meet the standards?)
- \* to know/establish baseline data on the process so that the effect of changes you may plan can be measured
- \* to learn/understand "what is and is not so" about the process
- \* to know necessary information for determining priorities and making fact-based decisions
- \* to learn what actions should be taken for bridging the possible gaps between where you are and where you want the process to be
- \* to confirm or disprove assumptions about the process
- \* to confirm that actions taken have had the expected results

A 16 Stage 3: ANALYZE Design Data Gathering - Determine What You Want to Know

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The screenshot shows a window titled "LearnerFirst Process Management - untitled.pma". The menu bar includes "File", "Edit", "Steps", "Database", "Screen", and "Help". The toolbar contains icons for file operations, a keyboard icon labeled "EXIT", and other navigation tools. The main content area has a dark header with the text "Design Data Gathering - Reflect On What You Already Know". Below this, it says "Consider the following questions in order to recognize what you already know." A progress indicator shows "1 of 6" with navigation arrows. The question text is: "What data currently exists? How often is it available? Does your customer agree that your product or service is 100% acceptable, always?". Below the question is a large text input field with a pencil icon on the left and a right-pointing arrow on the right. At the bottom, a status bar shows "A 17", "Stage 3: ANALYZE", and the current screen title.

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The screenshot shows the same software interface as above, but the progress indicator now shows "2 of 6". The question text is: "What format is the existing data in? What will have to be done to organize it in a format that will help to answer the questions you are trying to answer?". The rest of the interface, including the menu bar, toolbar, and status bar, is identical to the previous screenshot.

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The screenshot shows a software window titled "LearnerFirst Process Management - untitled.pma". The menu bar includes "File", "Edit", "Steps", "Database", "Screen", and "Help". The toolbar contains icons for file operations, a keyboard icon, a help icon, and a play button. The main content area has a dark header with the text "Design Data Gathering - Reflect On What You Already Know". Below this, it says "Consider the following questions in order to recognize what you already know." A progress indicator shows "3 of 6" with navigation arrows. The question text is: "Are 'hand-off' points clear and reconciled by all affected? Hand-off points are points where you pass information or the need for action to another party. It is important to gain acceptance for what you are handing off. To gain acceptance, you should be very clear to the recipient about what action should be taken. Are the standards tangible, quantifiable, and objective?". Below the question is a large text input field with a pencil icon on the left and a play button on the right. At the bottom, a status bar shows "A 17", "Stage 3: ANALYZE", and the current question title.

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The screenshot shows the same software window as above, but the progress indicator now shows "4 of 6". The question text is: "Are cycles present? Cycles are seasonal shifts like months or holiday times. What do you know about the cycles?". The rest of the interface, including the menu bar, toolbar, and status bar, is identical to the previous screenshot.

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The screenshot shows a software window titled "LearnerFirst Process Management - untitled.pma". The menu bar includes "File", "Edit", "Steps", "Database", "Screen", and "Help". The toolbar contains icons for file operations, navigation, and help. The main content area has a dark header with the text "Design Data Gathering - Reflect On What You Already Know". Below the header, it says "Consider the following questions in order to recognize what you already know." A progress indicator shows "5 of 6" with navigation arrows. The question text is: "What about differences from region to region? Is there some logical basis for focusing on a specific region or area?". Below the question is a large text input field with a pencil icon on the left and a play button on the right. At the bottom, a status bar shows "A 17", "Stage 3: ANALYZE", and the current question title.

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The screenshot shows a software window titled "LearnerFirst Process Management - untitled.pma". The menu bar includes "File", "Edit", "Steps", "Database", "Screen", and "Help". The toolbar contains icons for file operations, navigation, and help. The main content area has a dark header with the text "Design Data Gathering - Reflect On What You Already Know". Below the header, it says "Consider the following questions in order to recognize what you already know." A progress indicator shows "6 of 6" with navigation arrows. The question text is: "What do you already know about differences from department to department? What are the implications of these differences for the study? How should this be accounted for or addressed in your data collection plan?". Below the question is a large text input field with a pencil icon on the left and a play button on the right. At the bottom, a status bar shows "A 17", "Stage 3: ANALYZE", and the current question title.

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The screenshot shows a software window titled "LearnerFirst Process Management - untitled.pma". The menu bar includes "File", "Edit", "Steps", "Database", "Screen", and "Help". The toolbar contains icons for file operations, a keyboard icon, a help icon, and a navigation icon. The main content area has a title bar "Design Data Gathering - Consider the Practical Aspects" and a sub-header "Below are ten questions that will help you plan data collection:". A progress indicator shows "1 of 10". The question text reads: "What type of data will be collected - attributes or variables data? Attributes data ('counts' data) may be divided into 2 subclasses: Yes/No Data where each unit, job or task is classified as nonconforming or conforming, and Counted Data where each unit, job, or task is evaluated as to the count of nonconformities. Variables data result from measurements that characterize the amount of a property such as length, weight, torque, resistance, thickness, voltage, etc." Below the text is a large empty text box for the answer. The status bar at the bottom shows "A 18", "Stage 3: ANALYZE", and "Design Data Gathering - Consider the Practical Aspects".

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The screenshot shows the same software window as above. The progress indicator now shows "2 of 10". The question text reads: "Who will collect the data?". Below the text is a large empty text box for the answer. The status bar at the bottom remains the same: "A 18", "Stage 3: ANALYZE", and "Design Data Gathering - Consider the Practical Aspects".

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The screenshot shows a software window titled "LearnerFirst Process Management - untitled.pma". The menu bar includes "File", "Edit", "Steps", "Database", "Screen", and "Help". The toolbar contains icons for file operations, a keyboard icon, a help icon, and a navigation icon. The main content area has a dark header with the text "Design Data Gathering - Consider the Practical Aspects". Below this, a message reads "Below are ten questions that will help you plan data collection:". A navigation bar shows "3 of 10" with left and right arrow buttons. The question displayed is "How will the data be collected?". Below the question is a large empty text box with a pencil icon in the bottom-left corner. At the bottom of the window, a status bar shows "A 18", "Stage 3: ANALYZE", and "Design Data Gathering - Consider the Practical Aspects".

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The screenshot shows the same software window as above. The navigation bar now shows "4 of 10". The question displayed is "How often will you collect data?". The rest of the interface, including the header, message, and status bar, remains the same.

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File Edit Steps Database Screen Help

**Design Data Gathering - Consider the Practical Aspects**

Below are ten questions that will help you plan data collection:

5 of 10

How much data will be collected? Consider: whether cycles are present; whether the data is generated hourly, daily, weekly, machines, cycles, tools, etc.; whether you care about what the data will tell you. You should collect enough data so that: at least one complete cycle is documented; any existing "periods" are captured (beginning \_ending of month). Note: How quickly do you want to detect a change in the process and will the charted data identify such a change?

A 18 Stage 3: ANALYZE Design Data Gathering - Consider the Practical Aspects

LearnerFirst Process Management - untitled.pma  
File Edit Steps Database Screen Help

**Design Data Gathering - Consider the Practical Aspects**

Below are ten questions that will help you plan data collection:

6 of 10

What is the cost of data collection?

A 18 Stage 3: ANALYZE Design Data Gathering - Consider the Practical Aspects

The screenshot shows a software window titled "LearnerFirst Process Management - untitled.pma". The menu bar includes "File", "Edit", "Steps", "Database", "Screen", and "Help". The toolbar contains icons for file operations, navigation, and help. The main content area is titled "Design Data Gathering - Consider the Practical Aspects" and contains the text: "Below are ten questions that will help you plan data collection:". Below this is a navigation bar showing "7 of 10" and a text box with the question: "How will the data be analyzed? This question is related to question 1. If you will collect attribute/yes-no data, then use a 'p' or 'np' control chart. If attribute/counted data, then use a 'c' or 'u' control chart. If variable data are collected, then use X-MR or X-R control charts." There is a text input field with a pencil icon on the left and a navigation arrow on the right. The status bar at the bottom shows "A 18", "Stage 3: ANALYZE", and "Design Data Gathering - Consider the Practical Aspects".

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The screenshot shows the same software window as above, but now displaying question 8 of 10. The navigation bar shows "8 of 10". The text box contains the question: "Are special data collection forms required? If so, then who is responsible for developing the forms?". The rest of the interface, including the menu bar, toolbar, and status bar, remains the same.

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The screenshot shows a software window titled "LearnerFirst Process Management - untitled.pma". The menu bar includes "File", "Edit", "Steps", "Database", "Screen", and "Help". The toolbar contains icons for file operations, navigation, and help. The main content area has a header "Design Data Gathering - Consider the Practical Aspects" and a sub-header "Below are ten questions that will help you plan data collection:". A progress indicator shows "9 of 10". The question text is "Will people need training in data collection?". Below the question is a large text input field with a pencil icon on the left and a right arrow on the right. The status bar at the bottom shows "A 18", "Stage 3: ANALYZE", and "Design Data Gathering - Consider the Practical Aspects".

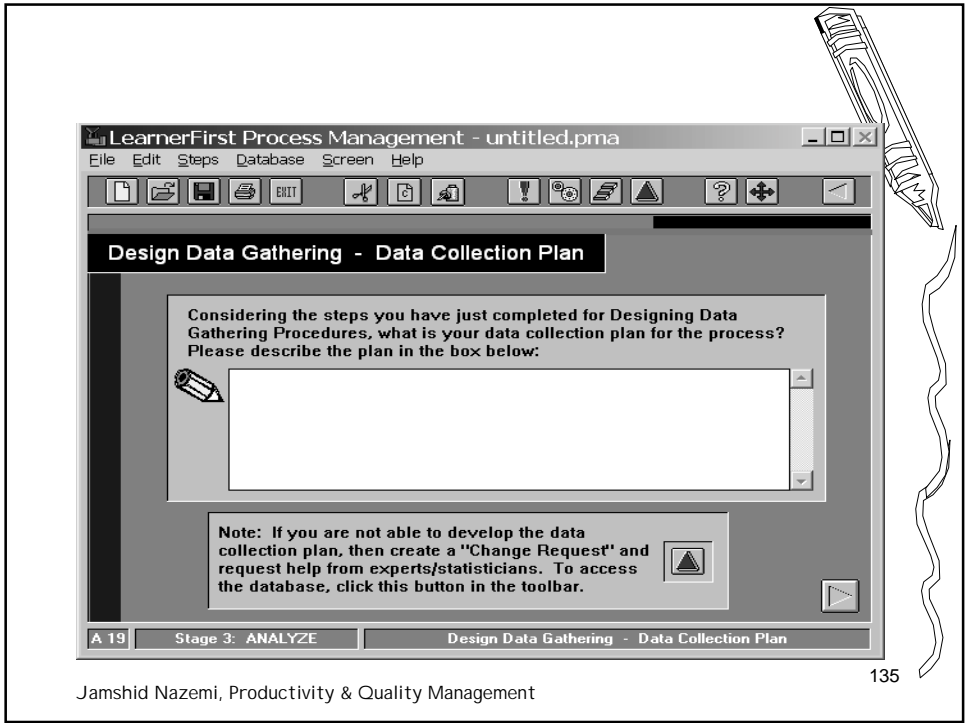
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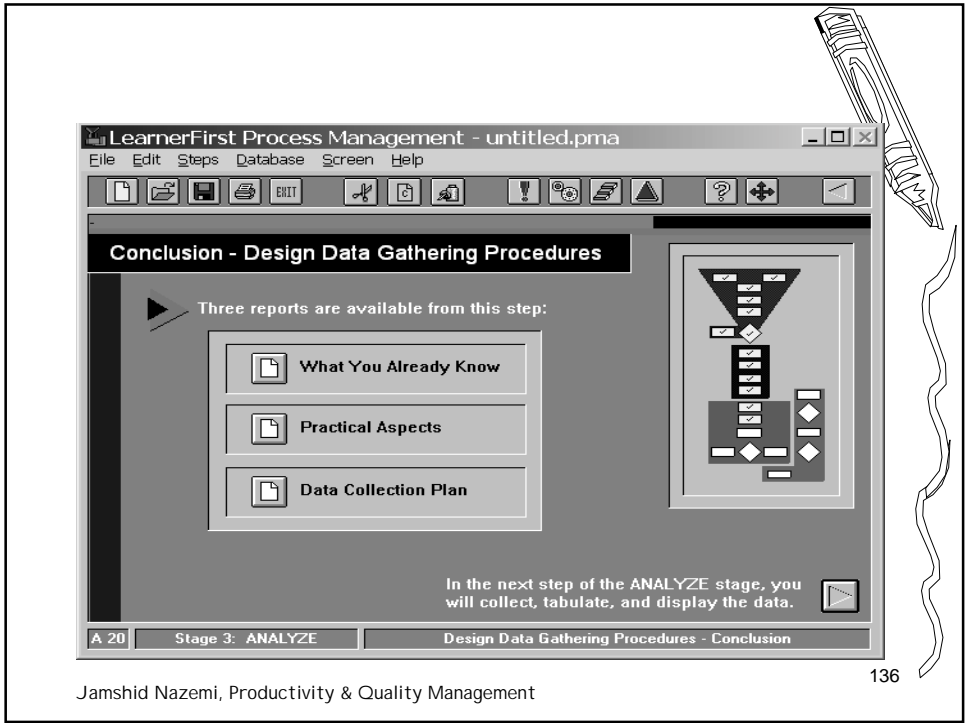
The screenshot shows the same software window as above, but the progress indicator now shows "10 of 10". The question text is "What data are not being collected that should be collected? What are the sources of variability that cause output changes?". The rest of the interface, including the menu bar, toolbar, and status bar, remains the same.

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### What You Already Know

#### Process:

Reflect On What You Already Know - You know whether or not the process is consistent (predictable); know how the process performs relative to supplier and customer requirements (does the process meet the standards?); know/establish baseline data on the process so that the effect of changes you may plan can be measured; understand "what is and is not so" about the process; know necessary information for determining priorities and making fact-based decisions; learn what actions should be taken for bridging the possible gaps between where you are and where you want the process to be; confirm or disprove assumptions about the process; confirm that actions taken have had the expected results.

Q. What data currently exists? How often is it available? Does your customer agree that your product or service is 100% acceptable, always?

A.

Q. What format is the existing data in? What will have to be done to organize it in a format that will help to answer the questions you are trying to answer?

A.

Q. Are "hand-off" points clear and reconciled by all affected? Hand-off points are points where you pass information or the need for action to another party. It is important to gain acceptance for what you are handing off. To gain acceptance, you should be very clear to the recipient about what action should be taken. Are the standards tangible, quantifiable, and objective? Should you further define the standards to assure that they are measurable?

A.

Q. Are cycles present? Cycles are seasonal shifts like months or holiday times. What do you know about the cycles?

A.

Q. What about differences from region to region? Is there some logical basis for focusing on a specific region or area?

A.

Q. What do you already know about differences from department to department? What are the implications of these differences for the study? How should this be accounted for or addressed in your data collection plan?

A.

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### Practical Aspects

#### Process:

Below are ten questions and answers that will help you plan data collection:

Q. What type of data will be collected - attributes or variables data? Attributes data ("counts" data) may be divided into 2 subclasses: Yes/No Data where each unit, job or task is classified as nonconforming or conforming, and Counted Data where each unit, job, or task is evaluated as to the count of nonconformities. Variables data result from measurements that characterize the amount of a property such as length, weight, torque, resistance, thickness, voltage, etc.

A.

Q. Who will collect the data?

A.

Q. How will the data be collected?

A.

Q. How often will you collect data?

A.

Q. How much data will be collected? Consider: whether cycles are present; whether the data is generated hourly, daily, weekly, machines, cycles, tools, etc.; whether you care about what the data will tell you. You should collect enough data so that: at least one complete cycle is documented; any existing "periods" are captured (beginning & ending of month). Note: How quickly do you want to detect a change in the process and will the charted data identify such a change?

A.

Q. What is the cost of data collection?

A.

Q. How will the data be analyzed? This question is related to question 1. If you will collect attribute/yes-no data, then use a "p" or "np" control chart. If attribute/counted data, then use a "c" or "u" control chart. If variable data are collected, then use X-MR or X-R control charts.

A.

Q. Are special data collection forms required? If so, then who is responsible for developing the forms?

A.

Q. Will people need training in data collection?

A.

Q. What data are not being collected that should be collected? What are the sources of variability that cause output changes?

A.

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# Data Collection Plan

**Collect Data**

What is this step?

In this step, you will be collecting, tabulating, and displaying data.

Why is this step done?

- Determine process consistency.
- Evaluate process acceptability.
- Create baselines for improvement.
- Provide data to guide improvement activities.

A 21 Stage 3: ANALYZE Collect Data - Introduction

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**Collect Data - Important Points to Remember**

▶ Here are some important points to remember about data collection.

**Be clear on the objectives beforehand.**  
Remember that data collection is often an ongoing, repetitive effort. Data collection may range from a small study to a large study which requires the assistance of a statistical specialist. Data collection is simplified by recognizing "what you already know." Initial efforts are used to guide subsequent efforts. Refining the data collection technique is "par for the course."

A 22 Stage 3: ANALYZE Collect Data - Important Points to Remember

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**Collect Data - Information about the Tools**

▶ There are several tools that you can use to record and summarize data. Click a button below to see a description and a brief set of instructions for each tool:

Run Charts	Cause and Effect Diagrams
Control Charts	Pareto Charts
Check Sheets	Histograms
Correlation	Cost of Quality

Information found in this screen is available in the "Descriptions and Instructions for Data Collection Tools" report (at conclusion of this step).

A 23 Stage 3: ANALYZE Collect Data - Information about the Tools

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**Collect Data - Information about the Tools**

**Run Charts**

Run charts are graphs of data points in time order. These data points may be measurements, counts or percentages of a product or service characteristic. Run charts may illustrate trends or cycles in the characteristic or serve as a preliminary step to using control charts.

Steps to create a Run Chart:

1. Identify the data needed and determine the frequency of data recording and total recording period.
2. Construct a graph with the measurement units at intervals along the vertical axis and the time intervals along the horizontal axis.
3. Place a mark on the graph to correspond to each measurement.
4. Connect all the marks. The resulting graph shows the magnitude and direction of changes in a process.

Click here for an example:

A 23 Stage 3: ANALYZE Collect Data - Information about the Tools

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**Collect Data - Information about the Tools**

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Example of a Run Chart

A 23 Stage 3: ANALYZE Collect Data - Information about the Tools

Detailed description: The screenshot shows a window titled 'Example of a Run Chart'. The chart's vertical axis is labeled 'Degrees Fahrenheit' with values 0, 25, 50, and 75. The horizontal axis is labeled 'Time'. A solid line represents the data points, which fluctuate over time, ending at approximately 75. A dashed line labeled 'Trend' shows a steady upward slope from 0 to 75.

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 A control chart is a graph of data in time order which displays data, a central line, and an upper and lower control limit. Control charts allow one to determine if and when a statistically significant change has occurred in a process. By viewing the control chart, you can determine whether the variation in a process over time is due to common causes only (the process is consistent), or whether it also contains special causes (the process is inconsistent). Why? So actions can be taken to change/improve the process.

**Steps to create a Run Chart:**

1. Determine the parameters that need to be controlled and ensure process owners know what action to take if the process is not consistent.
2. Determine the subgroup size, frequency and collect data.
3. Calculate control limits and the central line; plot limits and data on chart; analyze the pattern.
4. Determine if the process is consistent. If so, calculate capability and process performance. If not, take steps to achieve consistency.
5. Once the process is consistent, monitor the process for continued opportunity to improve by reducing variability and to get on target.

Click here for an example:

A 23 Stage 3: ANALYZE Collect Data - Information about the Tools

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Click here for an example:

A 23 Stage 3: ANALYZE Collect Data - Information about the Tools

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**Check Sheet**  
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Steps to create the Check Sheet:

1. Identify data for collection and determine time period for collection.
2. Set up the check sheet using data categories in a column down the left side of the sheet and the time intervals in a row across the top.
3. Clarify operational definitions of the events or incidents to be recorded with all participants. Gather data, marking the sheet according to the event and date of occurrence.
4. At the end of the specified time, tally the marks and record in the date/period columns.
5. Repeat for a specified number of time periods. Total the data from all periods and study major problem areas. Use this information to develop a summary graph, i.e., a histogram or a Pareto chart.

Click here for an example:

A 23 Stage 3: ANALYZE Collect Data - Information about the Tools

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Click here for an example:

Error	DATE: February, 1993					TOTAL
	2/5	2/11	2/17	2/23	2/28	
Lost Orders						15
Forecast						35
P.O. Wrong						7
Change Orders						14
Missed Calls						24

Example - Checksheet

A 23 Stage 3: ANALYZE Collect Data - Information about the Tools

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**Correlation**  
 A scatter diagram of two characteristics illustrates the existence of any association. Quality characteristics of products or services may be related or associated with other quality characteristics or characteristics of the process itself. Characteristics that are associated will show a linear pattern if enough data are available; unrelated characteristics will display a random pattern.

**Steps to create the Scatter Diagram:**

1. Determine data to be studied.
2. Collect paired samples of data.
3. Draw x- and y - axis beginning with zero at the connecting point and increase values going up and right.
4. Chart potential "cause" on horizontal axis and "effect" on vertical axis.
5. Plot data and determine if the resulting scatter is positive, negative, or no correlation.

Click here for an examples:

Instructions for Data Collection Tools - Report (at conclusion of this step).

A 23 Stage 3: ANALYZE Collect Data - Information about the Tools

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**Examples - scatter diagram**

	<b>Positive Correlation</b>	<b>Negative Correlation</b>	<b>No Correlation</b>
<b>Weight</b>			
	<b>Height</b>	<b>Temperature</b>	<b>Age</b>

Click here for an examples:

Instructions for Data Collection Tools - Report (at conclusion of this step).

A 23 Stage 3: ANALYZE Collect Data - Information about the Tools

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**Cause & Effect Diagrams ("Fishbone Charts")**

A cause and effect diagram is used to identify possible root causes of a problem and isolate those which are most likely responsible for the problem at a particular point in time. Construction of a FISHBONE CHART does not solve a problem, but ensures that you do not easily overlook a possible root cause, or apply fixes where they are unnecessary.

Steps to create the Fishbone Chart:

1. Draw a box on the right side of the paper and place in it the defined problem or needed improvement.
2. Draw a skeleton consisting of a central, horizontal baseline and branches. The branches should radiate at a 45-degree angle, above and below the baseline. If more primary cause branches are appropriate, add them.
3. Brainstorm and then attach more detailed causes and sub-causes to the primary causes.
4. Discuss all of the possible causes; eliminate those that do not apply and prioritize the remainder.
5. Focus on the most significant causes to eliminate, control or equalize their negative impact.

Click here for an example:

A 23 Stage 3: ANALYZE Collect Data - Information about the Tools

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**Cause & Effect Diagrams ("Fishbone Charts")**

A cause and effect diagram is used to identify possible root causes of a problem

Example of a Cause & Effect Diagram (Fishbone Chart)

A 23 Stage 3: ANALYZE Collect Data - Information about the Tools

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**PARETO Charts: "Vital Few" vs. "Trivial Many"**

**PARETO PRINCIPLE:** Investigations of problems (conditions) often reveal that a "vital few" causes (20%) account for the majority of the problems conditions. The remainder of the problems (conditions) result from the "trivial many" causes of problems (80%). A PARETO CHART is a bar chart which illustrates problem causes in order of severity by frequency (percent) of occurrence, cost or performance.

**Steps to create a Pareto Chart:**

1. Identify a variety of possible causes that contribute to the same issue (cause & effect diagram or brainstorming helpful).
2. Determine for the vertical axis the measurement unit common to the causes.
3. Select a time period for analysis and gather data relevant to each cause type.
4. Compare the measured data of each cause to that of each of the other causes and then list them from left to right on the horizontal axis in decreasing order of severity (quantity).
5. From the horizontal axis, draw a rectangle above each cause representing the total measured in that category.

Click here for an example:

A 23 Stage 3: ANALYZE Collect Data - Information about the Tools

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Click here for an example:

A 23 Stage 3: ANALYZE Collect Data - Information about the Tools

**Histograms - Distribution of Individual Values**

A Histogram is a graphic description of individual measured values in a data set according to frequency or relative frequency of occurrence. For large data sets, these values are often grouped in intervals to create a HISTOGRAM. Histograms illustrate the shape of the distribution of individual values in a data set, along with information regarding the average and variation. Histograms mask the time order of data; therefore, careful interpretation is required.

Steps to create a Histogram:

1. Gather and record data.
2. Prepare a frequency table from gathered data.
3. Using the frequency table, post the data that was recorded in each group to a graph.
4. Draw a rectangle to represent each group of data with the highest point corresponding to the number of times the particular incident or data was observed.
5. Analyze the data on the Histogram to determine the spread or variation of the data or for indications of unusual patterns in the shape that may indicate problems in the process.

Click here for an example:

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Click here for an example:

**Example of a Histogram**

A 23 Stage 3: ANALYZE Collect Data - Information about the Tools

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**C COST OF QUALITY**  
The Cost of Quality is a monetary tool used to put value on a process or issue in an "As Is" status. Cost of Quality provides a baseline whereby resources are invested to change the "As Is". Improvement causes a change that can be dollarized to show the return on investment (ROI) by having allocated resources for the changes "To Be".  
Steps to create the Cost of Quality - Nonconformance  
1. Identify critical process activities or events that vary over time and are wasting resources.  
2. With the help of Finance, place a value on these incidents to show monetary impact. Begin tracking data assigned a dollar value.  
3. Analyze data for root cause and alternatives for change.  
4. Make the change(s) based on reconciled agreement of all affected processes vs. data and track improvement by dollar value.  
5. Calculate the savings based on the difference between #2 and #4 above and publish the success story.

Click here for an example:

Click a tool:

A 23 Stage 3: ANALYZE Collect Data - Information about the Tools

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Example of a graph which  
 depicts the Cost of Quality.

Click a  
 tool:

OK

A 23 Stage 3: ANALYZE Collect Data - Information about the Tools

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**Collect Data - Select the Tools**

Below is the data collection plan that you documented earlier  
 in this stage. Please choose the tools for data collection.

Description of Data Collection Plan:  
 [Text Area]

Who will collect the data?  
 [Input Field]

When will the data collection  
 be completed?  
 [Input Field]

Please select (click) the  
 tool(s) for data collection.

- Run Charts
- Control Charts
- Check Sheets
- Correlation
- Cause & Effect Diagram
- Pareto Charts
- Histograms
- Cost of Quality

A 24 Stage 3: ANALYZE Collect Data - Select the Tools

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**Collect Data - Conclusion**

The report available from this step includes the descriptions and instructions for using each of the data collection tools.

**Descriptions & Instructions for Data Collection Tools**

**Note:** If you have change requests that you want to document, then use the "Change Request" database to document them. To access the database, click this button in the toolbar.

In the next step, you will decide if the process is operating in a stable or consistent manner.

A 25    Stage 3: ANALYZE    Collect Data - Conclusion

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Descriptions and Instructions for Data Collection Tools

**Important Points to Remember about Data Collection:** Need to be clear on the objectives beforehand. It is often an ongoing, repetitive effort. May range from a small study to a large study requiring the assistance of a statistical specialist. Data collection is simplified by recognizing "what we already know" before collecting any data. Initial efforts are used to guide subsequent efforts. Refinement of technique is "par for the course."

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Steps to create the Cost of Quality - Nonconformance Cost:

1. Identify critical process activities or events that vary over time and are wasting resources.
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3. Analyze data for root cause and alternatives for change.
4. Make the change(s) based on reconciled agreement of all affected processes vs. data and track improvement by dollar value.
5. Calculate the savings based on the difference between #2 and #4 above and publish the success story.

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**For Each Measure is the Process Consistent?**

- ▶ **What is this step?**  
This step will help you decide if the process is operating in a stable or consistent manner with respect to each measure.
- ▶ **Why is this step done?**  
Distinguish between common and special causes of variation. Determine if the future behavior of the process can be predicted.

A 26 Stage 3: ANALYZE For Each Measure is the Process Consistent? - Intro

**For Each Measure is the Process Consistent?**

An inconsistent process is unpredictable and subject to both common (random) and special (nonrandom) causes of variation. If insufficient data are available for a control chart, we often wrongly assume that the process is consistent. This increases the risk of fire fighting – addressing only the symptoms of a special cause or addressing a common cause as if it were special.

You should analyze the data with the appropriate control chart and proceed accordingly. For example, if the data is inconsistent, then you will address special causes. If the data is consistent, then you will evaluate acceptability.

A 27    Stage 3: ANALYZE    For Each Measure is the Process Consistent?

**For Each Measure is the Process Consistent?**

When a process is inconsistent, it means it is not behaving in the same way over time. Using control charts, there are four basic types of inconsistency:

1. Points on or outside the control limits. If a point falls on or outside the control limits, it is an indication that the process has changed. Control limits are based on probabilities. When a point falls on or outside the control limits, it is unusual since the probability is very small that this would happen if the process were truly consistent.
2. Shifts—seven consecutive points above or below central line. The presence of special causes is based upon statistical probabilities. If a

If you want to print out the four indications, click the report button.  Four Indications of Special Causes (on Control Charts)

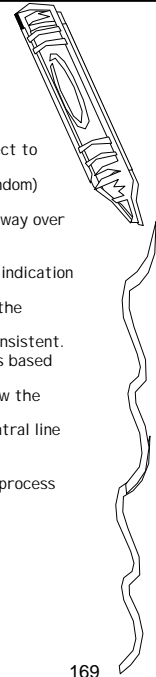
Based on your analysis, is the process consistent?

A 28    Stage 3: ANALYZE    For Each Measure is the Process Consistent? - Intro

#### Four Indications of Special Causes (on Control Charts)

It is important to decide if the process is operating in a stable or consistent manner with respect to each measure. An inconsistent process is nonpredictable and subject to both common (random) and special (nonrandom) causes of variation. When a process is inconsistent, it means it is not behaving or predictable in the same way over time. There are four basic indications of inconsistency or special causes on typical control charts:

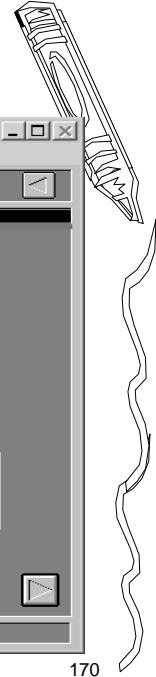
1. Points on or outside the control limits. If a point falls on or outside the control limits, it is an indication that the process has changed. Control limits are based on probabilities. When a point falls on or outside the control limits, it is unusual since the probability is very small that this would happen if the process were truly consistent.
2. Shifts-seven consecutive points above or below central line. The presence of special causes is based upon statistical probabilities. If a process is random, then the probability of a point falling either above or below the central line is about 50 percent. But the probability of seven consecutive points falling above or below the central line is usually less than 1%. Thus we can conclude that the process has changed.
3. Trends. Any obvious upward or downward movement of the data points can be a signal of the process changing even if all of the points stay within the control limits.
4. Patterns. Any obvious repetitive or cyclical patterns can also be a signal of process changes.



**Evaluate Process for Acceptability - Introduction**

- ▶ **What is this step?**  
**This step provides support for you to compare process performance to established standards.**
- ▶ **Why is this step done?**  
**Determine if the process is meeting the established standards. Gain information which will assist in prioritizing improvement efforts.**

A 32    Stage 3: ANALYZE    Evaluate Process for Acceptability - Introduction



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**Evaluate Process for Acceptability**

Note: A process can be consistent, but unacceptable to the customer. For example, a bank can serve 10 customers per hour in the drive through. This is the consistent rate hour-after-hour based on monthly data. However, customers have indicated that having to wait 5 minutes or more for service is unacceptable.

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How will you compare the process performance against established standards for each measure? Is the process capable and does it meet specified process performance criteria?

A 33 Stage 3: ANALYZE Evaluate Process for Acceptability

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**Evaluate Process for Acceptability - Conclusion**

► Congratulations! You have completed the ANALYZE stage of the LearnerFirst Process Management application. The result of this stage is a consistent and acceptable process.

Process Evaluation

A 34 Stage 3: ANALYZE Evaluate Process for Acceptability - Conclusion

Jamshid Nazemi, Productivity & Quality Management

Process Evaluation

Process:

Q. How will you compare the process performance against established standards for each measure? Is the process capable and does it meet specified process performance criteria?

A.

Q. Which of the following tools will you use to evaluate the process for acceptability? Consider using histograms or bar graphs. A histogram is a graphic description of individual measured values in a data set according to frequency or relative frequency of occurrence. A bar graph is used to compare one data set with another.

A.

Q. Is the process currently meeting the standard?

A.

Q. Will the process continue to meet the standard? This means, if a new standard is established, then data must be collected to determine if the change to a different criteria is being met and will continue to do so.

A.

Q. Have the process acceptance standards received concurrence, agreement, reconciliation with internal and external customers?

A.

Q. Enter relevant information for an Acceptance Log: Who has agreed? When agreed? What agreed? Contact person? Date?

A.

