6

Fact-Finding Techniques for Requirements Discovery

Overview

Chapter 6 provides a comprehensive look at the requirements gathering, and analysis activities. The chapter's intent is to introduce concepts, tools, and methods, which are used by today's systems analysts to discover requirements.

In this chapter great care is placed on defining what a requirement is and isn't, and the various types of requirements. Justification for this is based on the tremendous amount of problems in the IT industry when it comes to requirements definition.

Seven common fact-finding methods (Sampling, Research, Observation, Questionnaires, Interviews, Prototyping, Joint Requirements Planning) are introduced as a means to discover requirements. Each method is analyzed for its advantages and disadvantages, and in most cases guidelines are provided for their proper use, as well as an overall strategy for using them all.

Chapter to Course Sequencing

This chapter should follow Chapter 5 in all but exceptional course scenarios. It is the first chapter to introduce "how to" techniques and is a good lead-in for the "modeling" chapters. Typically you will proceed directly to Chapter 7, Modeling System Requirements with Use Cases, to model the requirements discovered in this chapter. Then you can move on to Chapter 8, Data Modeling and Analysis or Chapter 9, Process Modeling, in either order or, if you desire to take an object-oriented approach, to Chapter 11, Object-Oriented Analysis and Modeling Using the UML.

What's Different Here and Why?

The following changes have been made to the seventh edition of the information systems development chapter:

1. As with all chapters, we have streamlined the SoundStage episode into a quick narrative introduction to the concepts presented the chapter.

2. We moved the discussion of fact-finding ethics to the start of the Fact-Finding Techniques section to improve flow. We believe this move also allows for a fuller class discussion of the ethical implications of requirements discovery with each of the fact-finding techniques.

3. We added a new key term for the Requirements Definition Document to better emphasize this deliverable.

4.   We added a list of what analysts can clean from existing documentation.

5.   We expanded the discussion of how to conduct the interview, including tips for dressing to match the interviewee and how to ask "what if" questions.

Lesson Planning Notes for Slides

The following instructor notes, keyed to slide images from the PowerPoint repository, are intended to help instructors integrate the slides into their individual lesson plans for this chapter.

Slide 1

Chapter 6

Fact-Finding Techniques for Requirements Discovery
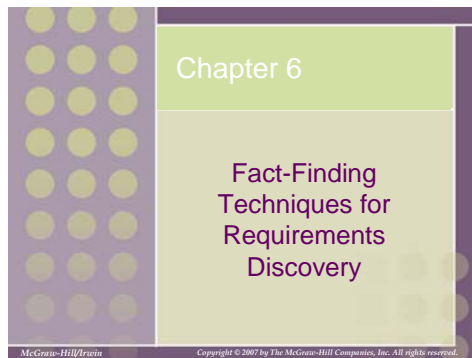
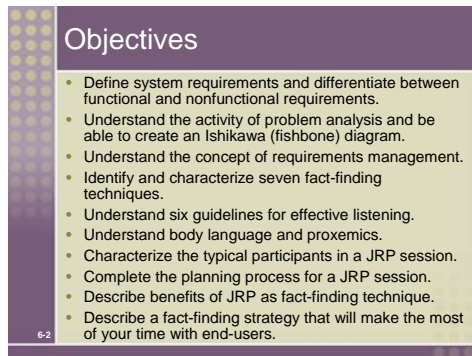slide appearance after initial mouse click in slide show mode

This repository of slides is intended to support the named chapter. The slide repository should be used as follows:
Copy the file to a unique name for your course and unit.
Edit the file by deleting those slides you don't want to cover, editing other slides as appropriate to your course, and adding slides as desired.
Print the slides to produce transparency masters or print directly to film or present the slides using a computer image projector.
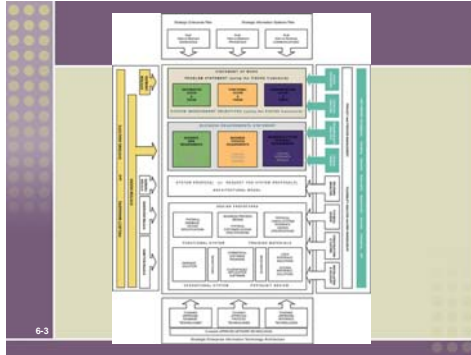
Most slides include instructor notes. In recent versions of PowerPoint, notes by default display in a window under the slide. The instructor notes are also reprinted below.

Slide 2

Objectives

- Define system requirements and differentiate between functional and nonfunctional requirements.
- Understand the activity of problem analysis and be able to create an Ishikawa (fishbone) diagram.
- Understand the concept of requirements management.
- Identify and characterize seven fact-finding techniques.
- Understand six guidelines for effective listening.
- Understand body language and proxemics.
- Characterize the typical participants in a JRP session.
- Complete the planning process for a JRP session.
- Describe benefits of JRP as fact-finding technique.
- Describe a fact-finding strategy that will make the most of your time with end-users.

Chapter 6 objectives.

Slide 3

Teaching Notes
This slide shows the how this chapter's content fits with the building blocks framework used throughout the textbook. Requirements Discovery is used throughout all the early phases; touches on knowledge, processes, and communications; and involves system owners, system users, and systems analysts.

Slide 4

Introduction to Requirements Discovery

Requirements discovery – the process and techniques used by systems analysts to identify or extract system problems and solution requirements from the user community.

System requirement – something that the information system must do or a property that it must have. Also called a *business requirement*.

Teaching Notes
This chapter focuses on the techniques and activities for eliciting system requirements as well as how to properly validate and document requirements. The authors have placed an emphasis on this chapter because recent studies have shown that as many as 80% of all system development failures can be traced back to problems with requirements.

Slide 5

Functional vs. Nonfunctional Requirements

Functional requirement - something the information system must <u>do</u>

Nonfunctional requirement - a property or quality the system must <u>have</u>
- Performance
- Security
- Costs

Conversion Notes
This slide is new in the seventh edition. The difference between functional and nonfunctional requirements is also covered in Chapter 5 but is repeated here because some instructors skip Chapter 5.

Slide 6

Results of Incorrect Requirements

- The system may cost more than projected.
- The system may be delivered later than promised.
- The system may not meet the users' expectations and they may not to use it.
- Once in production, costs of maintaining and enhancing system may be excessively high.
- The system may be unreliable and prone to errors and downtime.
- Reputation of IT staff is tarnished as failure will be perceived as a mistake by the team.

6-6

Teaching Notes
This slide (and the next) emphasize the importance of spending time in defining system requirements.

Slide 7

Relative Cost to Fix an Error

Phase in Which Error Discovered	Cost Ratio
Requirements	1
Design	3–6
Coding	10
Development Testing	15–40
Acceptance Testing	30–70
Operation	40–1000

6-7

Teaching Notes
Table based on work by Barry W. Boehm, a noted expert in information technology economics. Based on these findings, an erroneous requirement that goes undetected and unfixed until the operation phase may cost 1,000 times more than if it were detected and fixed in the requirements phase!

Slide 8

Criteria for System Requirements

- **Consistent** – not conflicting or ambiguous.
- **Complete** – describe all possible system inputs and responses.
- **Feasible** – can be satisfied based on the available resources and constraints.
- **Required** – truly needed and fulfill the purpose of the system.
- **Accurate** – stated correctly.
- **Traceable** – directly map to functions and features of system.
- **Verifiable** – defined so can be demonstrated during testing.

6-8

Teaching Notes
Requirements rarely initially emerge in a form that meets these criteria. Requirements discovery is an iterative process that involves refining and revising the requirements until they are correct.

Slide 9

Teaching notes
The process of requirements discovery consists of four activities.

Slide 10

Teaching Notes
Explain concept to students.
The name of the problem goes at the right of the diagram (the fish's head).
The possible causes of the problem are drawn as bones off the main backbone, grouped by 4 Ms (Materials, Machines, Manpower [People], and Methods) plus other categories that are appropriate to the problem at hand.
The team can then determine the most likely cause or causes.
Try to do another example during lecture based on a well-known problem that most students experience, such as college class registration.

Slide 11

Teaching Notes
Stress that fact-finding is a technique that is used across the entire development cycle but it is extremely critical in the requirements analysis phase.
Be sure to discuss the role of ethics during the fact-finding activity.

Slide 12

Documenting and Analyzing
Requirements

• Documenting the draft requirements
  • Use cases
  • Decision tables
  • Requirements tables
• Analyzing requirements to resolve problems
  • Missing requirements
  • Conflicting requirements
  • Infeasible requirements
  • Overlapping requirements
  • Ambiguous requirements
• Formalizing requirements
  • Requirements definition document
  • Communicated to stakeholders or steering body

6-12

No additional notes.

Slide 13

Requirements Definition
Document

Requirements Definition Document – A formal document that communicates the requirements of a proposed system to key stakeholders and serves as a contract for the systems project.

• Synonyms
  • Requirements definition report
  • Requirements statement
  • Requirements specification
  • Functional specifications

6-13

Conversion Notes
This is a new slide in the seventh edition

Slide 14

Sample Requirements
Definition Report Outline

REQUIREMENTS DEFINITION REPORT

1. Introduction
   1.1. Purpose
   1.2. Background
   1.3. Scope
   1.4. Definitions, Acronyms, and Abbreviations
   1.5. References
2. General Project Description
   2.1. Functional Requirements
3. Requirements and Constraints
   3.1. Functional Requirements
   3.2. Nonfunctional Requirements
4. Conclusion
   4.1. Outstanding Issues
Appendix (optional)

Teaching Notes
There is no standard name or format for this document. In fact, many organizations use different names such as requirements statement, requirements specification, requirements definition, functional specification, etc., and the format is usually tailored to that organization's needs.
For those companies that provide information systems and software to the U.S. government, the government requires that they use the format and naming conventions specified in their published standards document MIL-STD-498[1].
Many organizations have created their own standards adapted from MIL-STD-498 because of its thoroughness and because many people are already familiar with it.
In this book we will use the term *requirements definition document* .

[1] MIL-STD-498 is a standard that merges DOD-STD-2167A and DOD-STD-7935A to define a set of activities and documentation suitable for the development of both weapon systems and automated information systems.

Slide 15

Requirements Management

Requirements management - the process of managing change to the requirements.

- Over the lifetime of the project it is very common for new requirements to emerge and existing requirements to change.
- Studies have shown that over the life of a project as much as 50 percent or more of the requirements will change before the system is put into production.

6-15

Teaching Notes
You might want to have the class brainstorm on some of the problems that can be caused by adding requirements later. These would include conflict with existing requirements, major changes to data structures that impacts other parts of the design, and schedule and budget concerns.
Requirements management encompasses the policies, procedures, and processes that govern how a change to a requirement is handled. In other words, it specifies how a change request should be submitted, how it is analyzed for impact to scope, schedule, and cost, how it's approved or rejected, and how the change is implemented if approved.

Slide 16

Fact-Finding Ethics

- Fact-Finding often brings systems analysts into contact with sensitive information.
  - Company plans
  - Employee salaries or medical history
  - Customer credit card, social security, or other information
- Ethical behavior
  - Systems analysts must not misuse information.
  - Systems analysts must protect information from people who would misuse it.
- Otherwise
  - Systems analyst loses respect, credibility, and confidence of users and management, impairing ability to do job
  - Organization and systems analyst could have legal liability
  - Systems analyst could lose job

6-16

Teaching Notes
The instructor may want to share personal experiences about being in contact with sensitive information.

Slide 17

Seven Fact-Finding Methods

- Sampling of existing documentation, forms, and databases.
- Research and site visits.
- Observation of the work environment.
- Questionnaires.
- Interviews.
- Prototyping.
- Joint requirements planning (JRP).

6-17

Teaching Notes
Each will each be discussed later in the chapter.

Slide 18

Sampling Existing Documentation, Forms, & Files

Sampling –process of collecting a representative sample of documents, forms, and records.
- Organization chart
- Memos and other documents that describe the problem
- Standard operating procedures for current system
- Completed forms
- Manual and computerized screens and reports
- Samples of databases
- Flowcharts and other system documentation
- And more

6-18

No additional notes.

Slide 19

Things to be Gleaned from Documents

- Symptoms and causes of problems
- Persons in organization who have understanding of problem
- Business functions that support the present system
- Type of data to be collected and reported by the system
- Questions that need to be covered in interviews

6-19

Conversion Notes
This is a new slide for the seventh edition
Teaching Notes
The instructor could bring in memos, organization charts, etc. (subject to fact-finding ethics) to demonstrate how these kinds of information could be gleaned from those documents.

Slide 20

Why to Sample Completed Rather than Blank Forms

- Can determine type of data going into each blank
- Can determine size of data going into each blank
- Can determine which blanks are not used or not always used
- Can see data relationships

6-20

Teaching Notes
As an class exercise you can walk through this form from an old case study to see what the data tells you. Depending on the classes prior to fa-miliarity with database concepts, this form can reveal:
That computer names are alphanumeric
That assigned to appears to be a 3-character initial
That Ext is a 4-digit extension number and not a full phone number
That the Problem Description is a large text area that sometimes contains only a few words.
That there is a one-to-many relationship between Service Requests and the work done on them.
That Work Comments is a large text area.

Slide 21

Determining Sample Size for Forms

- Sample Size = 0.25 x (Certainty factor/Acceptable error) ^{2}
- Sample Size = 0.25(1.645/0.10) ^{2} = 68
- Sample Size =0.10(1 − 0.10)(1.645/0.10)^2 = 25

> Or if analyst knows 1 in 10 varies from norm.

> Certainty factor from certainty table. 10% acceptable error.

Desired Certainty	Certainty Factor
95%	1.960
90	1.645
80	1.281

6-21

Teaching Notes
Two versions of the sampling formula are provided in the textbook. The first uses a heuristic (.25) to calculate the sample size and the second replaces the (.25) with p(1-p) to reflect the knowledge of errors in the sample population. Review each with students and calculate various sample sizes using different levels of certainty.

Slide 22

Sampling Techniques

Randomization – a sampling technique characterized by having no predetermined pattern or plan for selecting sample data.

Stratification – a systematic sampling technique that attempts to reduce the variance of the estimates by spreading out the sampling—for example, choosing documents or records by formula—and by avoiding very high or low estimates.

6-22

Teaching Notes
For randomization you just randomly choose the number of sample items based on the sample size calculated.
For computerized files, stratification sampling can be executed by writing a simple program. For instance, suppose invoices were stored in a database that had a volume of approximately 250,000. If the required sample size was 25, a program could be written that prints every 10,000th record (=250,000/25).

Slide 23

Observation

Observation – a fact-finding technique wherein the systems analyst either participates in or watches a person perform activities to learn about the system.
  Advantages?
  Disadvantages?

Work sampling - a fact-finding technique that involves a large number of observations taken at random intervals.

6-23

Teaching Notes
This technique is often used when the validity of data collected through other methods is in question or when the complexity of certain aspects of the system prevents a clear explanation by the end-users.
Have students review The Railroad Paradox by Gerald M. Weinberg. Discuss the moral of the story.
Have students provide advantages and disadvantages of observation.

Slide 24

Observation

Advantages	Disadvantages
• Data gathered can be very reliable • Can see exactly what is being done in complex tasks • Relatively inexpensive compared with other techniques • Can do work measurements	• People may perform differently when being observed • Work observed may not be representative of normal conditions • Timing can be inconvenient • Interruptions • Some tasks not always performed the same way • May observe wrong way of doing things

6-24

Conversion Notes
This is a new slide in the seventh edition.

Slide 25

Observation Guidelines

- Determine the who, what, where, when, why, and how of the observation.
- Obtain permission from appropriate supervisors.
- Inform those who will be observed of the purpose of the observation.
- Keep a low profile.
- Take notes.
- Review observation notes with appropriate individuals.
- Don't interrupt the individuals at work.
- Don't focus heavily on trivial activities.
- Don't make assumptions.

6-25

No additional notes.

Slide 26

Questionnaires

Questionnaire – a special-purpose document that allows the analyst to collect information and opinions from respondents.

Free-format questionnaire – a questionnaire designed to offer the respondent greater latitude in the answer. A question is asked, and the respondent records the answer in the space provided after the question.

Fixed-format questionnaire – a questionnaire containing questions that require selecting an answer from predefined available responses.

6-26

Teaching Notes
Have students provide advantages and disadvantages of observation.
Have students provide examples of both free-format and fixed-format questions. The difference between the two is essentially the difference between a multiple-choice and essay exam.

Slide 27

Questionnaires

Advantages	Disadvantages
• Often can be answered quickly	• Return rate is often low
• People can complete at their convenience	• No guarantee that an individual will answer all questions
• Relatively inexpensive way to gather data from a large number	• No opportunity to reword or explain misunderstood questions
• Allow for anonymity	• Cannot observe body language
• Responses can be tabulated quickly	• Difficult to prepare

6-27

Conversion Notes
This is a new slide in the seventh edition.

Slide 28

Types of Fixed-Format Questions

- Multiple-choice questions
- Rating questions
- Ranking questions

Rank the following transactions according to the amount of time you spend processing them.
___ % new customer orders
___ % order cancellations
___ % order modifications
___ % payments

The implementation of quality discounts would cause an increase in customer orders.
___ Strongly agree
___ Agree
___ No opinion
___ Disagree
___ Strongly disagree

Is the current accounts receivable report that you receive useful?
___ Yes
___ No

6-28

Teaching Notes
Ask students to classify each of the sample questions.
For **multiple-choice questions**, the respondent is given several answers. The respondent should be told if more than one answer might be selected.
For **rating questions**, the respondent is given a statement and asked to use supplied responses to state an opinion. To prevent built-in bias, there should be an equal number of positive and negative ratings.
For **ranking questions**, the respondent is given several possible answers, which are to be ranked in order of preference or experience.

Slide 29

Developing a Questionnaire

1. Determine what facts and opinions must be collected and from whom you should get them.
2. Based on the facts and opinions sought, determine whether free- or fixed-format questions will produce the best answers.
3. Write the questions.
4. Test the questions on a small sample of respondents.
5. Duplicate and distribute the questionnaire.

6-29

No additional notes.

Slide 30

Interviews

Interview - a fact-finding technique whereby the systems analysts collect information from individuals through face-to-face interaction.

- Find facts
- Verify facts
- Clarify facts
- Generate enthusiasm
- Get the end-user involved
- Identify requirements
- Solicit ideas and opinions

The personal interview is generally recognized as the most important and most often used fact-finding technique.

6-30

Teaching Notes
Have students provide advantages and disadvantages of interviews.

Slide 31

Types of Interviews and Questions

Unstructured interview –conducted with only a general goal or subject in mind and with few, if any, specific questions. The interviewer counts on the interviewee to provide a framework and direct the conversation.

Structured interview –interviewer has a specific set of questions to ask of the interviewee.

Open-ended question – question that allows the interviewee to respond in any way.

Closed-ended question – a question that restricts answers to either specific choices or short, direct responses.

6-31

Teaching Notes
An unstructured interview frequently gets off track, and the analyst must be prepared to redirect the interview back to the main goal or subject. For this reason, unstructured interviews don't usually work well for systems analysis and design.
Have students provide examples of open-ended and closed-ended questions.

Slide 32

Interviews

Advantages
- Give analyst opportunity to motivate interviewee to respond freely and openly
- Allow analyst to probe for more feedback
- Permit analyst to adapt or reword questions for each individual
- Can observe nonverbal communication

Disadvantages
- Time-consuming
- Success highly dependent on analyst's human relations skills
- May be impractical due to location of interviewees

6-32

Conversion Notes
This slide is new in the seventh edition.

Slide 33

Procedure to Conduct an Interview

1. Select Interviewees
   - End users
   - Learn about individual prior to the interview
2. Prepare for the Interview
   - interview guide
3. Conduct the Interview
   - Summarize the problem
   - Offer an incentive for participation
   - Ask the interviewee for assistance
4. Follow Up on the Interview
   - Memo that summarizes the interview

6-33

No additional notes.

Slide 34

Sample Interview Guide

6-34   (continued)

No additional notes.

Slide 35

Sample Interview Guide (concluded)

6-35

No additional notes.

Slide 36

Prepare for the Interview

- Types of Questions to Avoid
  - Loaded questions
  - Leading questions
  - Biased questions
- Interview Question Guidelines
  - Use clear and concise language.
  - Don't include your opinion as part of the question.
  - Avoid long or complex questions.
  - Avoid threatening questions.
  - Don't use "you" when you mean a group of people.

6-36

Teaching Notes
Have students provide examples of loaded, leading, and biased questions.

Slide 37

Conduct the Interview

- Dress to match interviewee
- Arrive on time
  - Or early if need to confirm room setup
- Open interview by thanking interviewee
- State purpose and length of interview and how data will be used
- Monitor the time
- Ask follow-up questions
  - Probe until you understand
  - Ask about exception conditions ("what if...")

6-37

Conversion Notes
This is a new slide in the seventh edition.

Slide 38

Interviewing Do's and Don'ts

Do	Don't
• Dress appropriately	• Assume an answer is finished or leading nowhere
• Be courteous	
• Listen carefully	• Reveal verbal and nonverbal clues
• Maintain control of the interview	• Use jargon
• Probe	• Reveal personal biases
• Observe mannerisms and nonverbal communication	• Talk more than listen
• Be patient	• Assume anything about the topic or the interviewee
• Keep interviewee at ease	• Tape record (take notes instead)
• Maintain self-control	
• Finish on time	

6-38

Teaching Notes
Discuss with the students each of the items and the reasons for their classifications.

Slide 39

Body Language and Proxemics

Body language – the nonverbal information we communicate.
- Facial disclosure
- Eye contact
- Posture

Proxemics – the relationship between people and the space around them.
- Intimate zone—closer than 1.5 feet
- Personal zone—from 1.5 feet to 4 feet
- Social zone—from 4 feet to 12 feet
- Public zone—beyond 12 feet

6-39

Teaching Notes
Research studies have determined a startling fact — of a person's total feelings, only 7 percent are communicated verbally (in words), 38 percent are communicated by the tone of voice used, and 55 percent of those feelings are communicated by facial and body expressions.
Certain types of communications take place only in some of these zones. For example, an analyst conducts most interviews with system users in the personal zone. But the analyst may need to move back to the social zone if the user displays any signs (body language) of being uncomfortable. Sometimes increasing eye contact can make up for a long distance that can't be changed. Many people use the fringes of the social zone as a "respect" distance.

Slide 40

Discovery Prototyping

Discovery prototyping – the act of building a small-scale, representative or working model of the users' requirements in order to discover or verify those requirements.

6-40

Teaching Notes
Discovery prototyping is frequently applied to systems development projects, especially in those cases where the development team is having problems defining the system requirements. The philosophy is that the users will recognize their requirements when they see them.
Have students provide advantages and disadvantages of discovery prototyping.

Slide 41

Discovery Prototyping

Advantages	Disadvantages
• Can experiment to develop understanding of how system might work	• Developers may need to be trained in prototyping
• Aids in determining feasibility and usefulness of system before development	• Users may develop unrealistic expectations
• Serves as training mechanism	• Could extend development schedule
• Aids in building test plans and scenarios	
• May minimize time spent on fact-finding	

6-41

Conversion Notes
This is a new slide in the seventh edition.

Slide 42

Joint Requirements Planning

Joint requirements planning (JRP) – a process whereby highly structured group meetings are conducted for the purpose of analyzing problems and defining requirements.

- JRP is a subset of a more comprehensive joint application development or JAD technique that encompasses the entire systems development process.

6-42

Teaching Notes
JRP (and JAD) techniques are becoming increasingly common in systems planning and systems analysis to obtain group consensus on problems, objectives, and requirements.

Slide 43

JRP Participants

- Sponsor
- Facilitator
- Users and Managers
- Scribes
- IT Staff

6-43

Teaching Notes
Discuss the role of each. Be sure to focus on the skills needed to be a successful JRP facilitator.

Slide 44

Steps to Plan a JRP Session

1. Selecting a location
   - Away from workplace when possible
   - Requires several rooms
   - Equipped with tables, chairs, whiteboard, overhead projectors
   - Needed computer equipment
2. Selecting the participants
   - Each needs release from regular duties
3. Preparing the agenda
   - Briefing documentation
   - Agenda distributed before each session

6-44

Teaching Notes
Discuss why the JRP session location should be held off-site.
Discuss why many companies opt to hire qualified JRP facilitators from outside the organization.

Slide 45
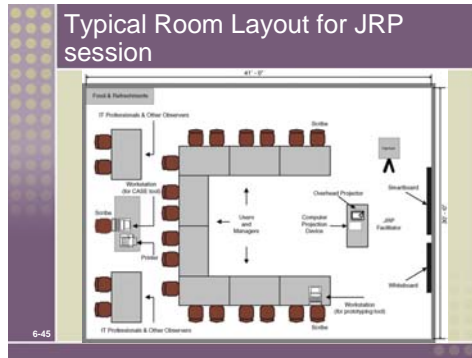
Typical Room Layout for JRP session

6-45

Slide 46

Guidelines for Conducting a JRP Session

- Do not unreasonably deviate from the agenda
- Stay on schedule
- Ensure that the scribe is able to take notes
- Avoid the use of technical jargon
- Apply conflict resolution skills
- Allow for ample breaks
- Encourage group consensus
- Encourage user and management participation without allowing individuals to dominate the session
- Make sure that attendees abide by the established ground rules for the session

6-46

No additional notes.

Slide 47

Brainstorming

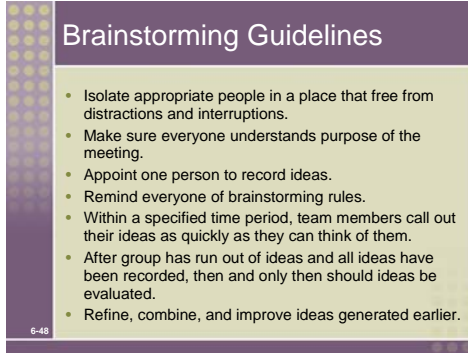- Sometimes, one of the goals of a JRP session is to generate possible ideas to solve a problem.
  - Brainstorming is a common approach that is used for this purpose.

Brainstorming – a technique for generating ideas by encouraging participants to offer as many ideas as possible in a short period of time without any analysis until all the ideas have been exhausted.

6-47

No additional notes.

Slide 48

Brainstorming Guidelines

- Isolate appropriate people in a place that free from distractions and interruptions.
- Make sure everyone understands purpose of the meeting.
- Appoint one person to record ideas.
- Remind everyone of brainstorming rules.
- Within a specified time period, team members call out their ideas as quickly as they can think of them.
- After group has run out of ideas and all ideas have been recorded, then and only then should ideas be evaluated.
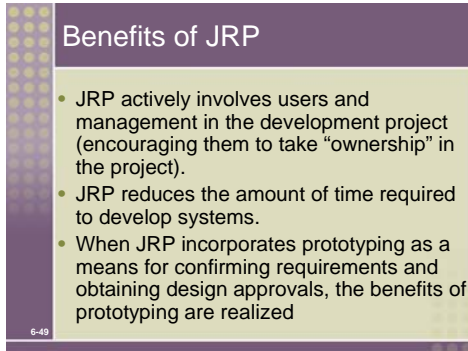- Refine, combine, and improve ideas generated earlier.

6-48

Teaching Notes
Be sure to discuss the rules of brainstorming:
Be spontaneous. Call out ideas as fast as they occur.
Absolutely no criticism, analysis, or evaluation of any kind is permitted while the ideas are being generated. Any idea may be useful, if only to spark another idea.
Emphasize quantity of ideas, not necessarily quality.

Slide 49

Benefits of JRP

- JRP actively involves users and management in the development project (encouraging them to take "ownership" in the project).
- JRP reduces the amount of time required to develop systems.
- When JRP incorporates prototyping as a means for confirming requirements and obtaining design approvals, the benefits of prototyping are realized
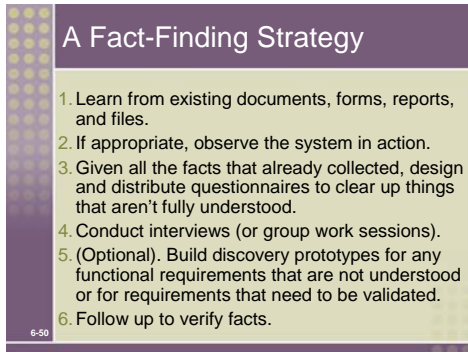
6-49

Teaching Notes
Discuss the reasons why JRP reduces the amount of time required to develop systems. Note the differences between calendar time and person-hours. JRP may require more person-hours but reduces calendar time. Ask the students to name situations in which minimizing one or the other would be more important.

Slide 44

A Fact-Finding Strategy

1. Learn from existing documents, forms, reports, and files.
2. If appropriate, observe the system in action.
3. Given all the facts that already collected, design and distribute questionnaires to clear up things that aren't fully understood.
4. Conduct interviews (or group work sessions).
5. (Optional). Build discovery prototypes for any functional requirements that are not understood or for requirements that need to be validated.
6. Follow up to verify facts.

6-50

Teaching Notes
This is one possible strategy, but one that minimizes wasting user time.
An analyst needs an organized method for collecting facts. An inexperienced analyst will frequently jump right into interviews. "Go to the people. That's where the real facts are!" Wrong! This attitude fails to recognize an important fact of life: people must complete their day-to-day jobs! Your job is not their main responsibility. Your demand on their time is their time and money lost.

Answers to End of Chapter Questions and Exercises

Review Questions

1. Requirements discovery is of the utmost importance because we must correctly   identify, analyze, and understand the users' requirements, and/or what the users want the system to do, in order to effectively design, construct, and ultimately implement a system to meet their needs.

2.
   - The system may cost more than projected.
   - The system may be delivered later than promised.
   - The system may not meet the users' expectations, and that dissatisfaction may cause them not to use it.
   - Once in production, the costs of maintaining and enhancing the system may be excessively high.
   - The system may be unreliable and prone to errors and downtime.
   - The reputation of the IT staff on the team is tarnished because any failure, regardless of who is at fault, will be perceived as a mistake by the team.

3.
   - Consistent—the requirements are not conflicting or ambiguous.
   - Complete—the requirements describe all possible system inputs and responses.
   - Feasible—the requirements can be satisfied based on the available resources and constraints.
   - Required—the requirements are truly needed and fulfill the purpose of the system.
   - Accurate—the requirements are stated correctly.
   - Traceable—the requirements directly map to the functions and features of the system.
   - Verifiable—the requirements are defined so that they can be demonstrated during testing.

4.
   - Problem discovery and analysis
   - Requirements discovery
   - Documenting and analyzing requirements
   - Requirements management

5. An Ishikawa diagram is a graphical tool used by developers to identify, explore, and depict problems, and the causes and effects of those problems. It is often referred to as a cause-and-effect diagram or a fishbone diagram because of its shape.

   The basic concept of the Ishikawa diagram is that the name of the problem of interest is entered at the right of the diagram (or the fish's head) and

the possible causes of the problems are drawn as "bones" off the main backbone. In general, there are four basic categories of bones: materials, machines, manpower and methods. As alternative or additional categories, the categories can include places, procedures, policies and people, or surroundings, suppliers, systems and skills.

6. Fact-finding is the technique commonly used. Fact-finding is the formal process of using research, meetings, interviews, questionnaires, sampling, and other techniques to collect information about system problems, requirements, and preferences. It is also called information gathering or data collection.

   Fact finding is a critical part of the requirements analysis phase because facts are the domain of the business application and its end users. Thus, the analyst must collect those facts accurately and completely in order to effectively apply the documentation tools and techniques, such as use cases, data models, process models and object models.

7. During the fact-finding activities, it is not uncommon that some of the requirements may be in conflict with one another because requirements are gathered from many different sources and perspectives. Thus, the goal of requirement analysis is to discover and solve the problems with the requirements, and to reach agreement on any modifications to satisfy the needs of the stakeholders. If we do not do that, problems such as missing requirements, conflicting requirements, infeasible requirements, overlapping requirements, and ambiguous requirements may occur.

8. The documents describing the problem of the current system.

   Examples: Interoffice memoranda, studies, minutes, suggestion box notes, customer complaints, reports that document the problem area, Accounting records, performance reviews, and information system project requests.

   a. The documents describing the business functions being studied or designed
      Examples:
      - The company's mission statement and strategic plan
      - Formal objectives for the organization subunits being studied
      - Policy manuals that may place constraints on any proposed system
      - Completed forms that represent actual transactions at various points in the processing cycle.

   b. The documents of previous system studies and designs performed by former system analysts and consultants.
      Examples:
      - Various types of flowcharts and diagrams

- Project dictionaries and repositories
- Design documentation, such as inputs, outputs, and databases
- Program documentation
- Computer operations manuals and training manuals

9. • People at work may unwittingly perform differently when being observed because people usually feel uncomfortable being watched.

   • The work being observed may not involve the level of difficulty or volume normally experienced during that time period.

   • Some system activities may take place at odd times, causing a scheduling inconvenience for the system analyst.

   • The tasks being observed are subject to various types of interruptions.

   • Some tasks may not always be performed in the manner in which they are observed by the system analyst.

   • If people have been performing tasks in a manner that violates standard operating procedures, they may temporarily perform their jobs correctly while you are observing them.

   • To offset these drawbacks, systems analysts can use a technique called work sampling. It is a fact-finding technique that involves taking a large number of observations at random intervals. This technique tends to be less intimidating to the people being observed because the observation period is not continuous.

10. Free-format questionnaire—a questionnaire designed to offer the respondent greater latitude in the answer. A question is asked, and the respondent records the answer in the space provided after the question.

   Fixed-format questionnaire—a questionnaire containing questions that require selecting an answer from predefined available responses.

11. • Approach the session with a positive attitude
    • Set the other person at ease
    • Let the other person know you are listening
    • Ask questions
    • Don't assume anything
    • Take notes

12. It is a process whereby highly structured group meetings are conducted for the purpose of analyzing problems and defining requirements.

13. JRP offers many benefits. Some of these benefits are:

- JRP actively involves users and management in the development project, and encourages them to "own" the project.

- JRP reduces the amount of time required to develop systems. This is achieved by replacing traditional, time-consuming one-on-one interviewing of each user and manager with group meetings. The group meetings allow for more easily obtaining consensus among the users and managers, as well as resolving conflicting information and requirements.

- When JRP incorporates prototyping as a means for confirming requirements and obtaining design approvals, the benefits of prototyping are realized.

14. The JRP facilitator is usually responsible for leading all sessions that are held for a system project. The facilitator's role is to plan the JRP session, conduct the session, and follow through on the results. During the session, the facilitator is responsible for leading the discussion, encouraging the attendees to actively participate, resolving issue conflicts that may arise, and ensuring that the goals and objectives of the meeting are fulfilled. The facilitator also needs to establish the ground rules that will be followed during the meeting and ensure that the participants abide by these rules.   Whether a JRP session is productive and successful or not is highly dependent on the abilities of the facilitator. .

15. JRP sessions should be conducted away from the company workplace. By holding JRP session at an off-site location, the attendees can concentrate on the issues and activities related to the JRP session, and avoid interruptions and distractions that would occur at their regular workplace.

Problems and Exercises

1. The purpose of requirements discovery is straightforward: to identify accurately and completely the requirements needed for the new system to satisfy its objectives. If this is not done, there is a high probability that at least one of the following will occur:
   a. The project will run over budget
   b. The project will take longer than scheduled
   c. The system will not meet expectations
   d. Once the system is implemented, the ongoing cost of operations may be higher than projected.

e. The system may not be reliable

f. The IT division may lose credibility because business staff will tend to see any system failure or problems as their fault.

As for fixing any missed requirements if and when they are discovered further downstream in the project, the system owners should know that costs rise exponentially in each succeeding phase of the project. This means that for every dollar spent during requirements discovery to fix an error, $3 - $6 will be spent during the design phase, $10 will be spent during the construction phase to fix the same error, $30 - $70 during acceptance testing, and up to $1000 after the system is implemented.

2. Every requirement must meet <u>each</u> of the following criteria in order to be considered a correct requirement:

a. Is the requirement clear and consistent?

b. Is the requirement complete, i.e., does it include all inputs and outputs?

c. Is the requirement feasible, i.e., can it done within the identified constraints and available resources?

d. Is the requirement actually required and needed in order to meet the system objectives?

e. Is the requirement accurately stated?

f. Is the requirement traceable, i.e., can the requirement be mapped to specific system functions and features?

g. Is the requirement verifiable, i.e., can the requirement be tested?

3. Inexperienced analysts frequently tend to confuse a symptom with the actual problem. This error can lead to designing a solution that probably will not address the real problem, or worse, creates a new problem without solving the original problem!

To reduce the risk of this occurring, systems analysts can use an Ishikawa or fishbone diagram to identify the possible causes of the problem. This is a graphical diagram that roughly resembles the skeleton of a fish. The perceived problem is shown on the right, then possible causes are grouped by category off the main "backbone" of the diagram. These categories may be materials, machines, manpower and methods; places, procedures, policies and people; or surrounding, suppliers, systems and skills. The completed diagram lists all possible causes, and is used by the project team to brainstorm what are the most likely causes of the problem.

4. Fact-finding that is accurate and complete is important in every stage. However, accurate and complete fact-finding is particularly important in the requirements analysis phase. This is because documentation tools and techniques, such as use cases, data models, process models and object models, require a solid requirements analysis foundation in order to be effectively applied.

5. During requirements discovery, system analysts generally review and/or have access to a great deal of documentation regarding the business or organization. There is a good chance that some of this documentation may include sensitive or confidential information, such as employee salaries or health information, trade secrets regarding the company's products or services, proprietary information regarding their business plans and marketing strategies, etc.

   The consequences of inappropriate disclosure of this information, whether by carelessness or deliberately, can cause the company and/or employees great damage. Further, the company and/or individuals responsible may be held legally liable for the disclosure.

   Therefore, project staff, whether employees or contractors, must do essentially two things: they must handle and store documents in such a manner as to ensure that security and confidentiality is not breached. Further, they must ensure that they do not use the information for their own personal gain, or to allow it to be used for the personal gain of anyone else.

6. Common tools and techniques for documenting initial findings include
   - Use cases for describing system functions from the perspective of external users using non and which are written in non-technical language
   - Requirements tables (or matrices) listing each individual functional requirement
   - Decision tables listing the organizations policies, business roles, and criteria for making decisions.

   At this point, the systems analyst definitely should not expect the requirements to be complete and correct, and to be skeptical if they appear to be! Typical problems that occur and which should be found at this point include requirements that are:
   - Missing
   - Contradictory
   - Not feasible
   - Confusing or ambiguous
   - Do not stand alone or are not discrete, i.e., they overlap with other requirements

   The focus at this point should be on reaching stakeholder agreement by reviewing the requirements to determine whether the right system requirements for the project have been identified. This process will reveal if the above problems exist, which will need to be fixed now to avoid snowballing further down the development cycle.

8. Once the requirements analysis is completed, a requirements definition document should be drafted. The purpose of the requirements definition document is to provide a formal and structured vehicle for communicating the functional requirements to the core stakeholders for their review. Once this document is finalized, it becomes in effect a contract between the system owners and the developers as to what is to be provided in the new system. Typically, the requirements definition document includes:
   - System purpose and scope
   - Functional requirements
   - Nonfunctional requirements
   - Constraints, both developmental and operational
   - System interfaces
   - Outstanding issues

9. The 'rule-of-thumb' formula for determining formula size is:

   Sample size = .025 X (Certainty factor/Acceptable error)^2

   With a certainty factor of 95%, the sample size would be calculated as follows:

   SS = $0.25(1.960/0.05)^2$ = 384

   Increasing the number of sales orders per day to 25,000 does not change the sampling size; it remains the same.

10. Advantages include:
   - Very cost-effective method to quickly get uniform information from large groups of stakeholders
   - Stakeholders can respond to most surveys at their convenience and without spending a great deal of time.
   - Stakeholders may be more candid because surveys can be answered anonymously
   - Compilation of the results is generally straightforward and rapid.

    Disadvantages include:
   - Survey questions may be ambiguous and/or subject to misinterpretation, which can skew the results.
   - Stakeholders may skip certain questions, or not respond at all to the survey
   - The systems analyst cannot ask additional questions or observe the respondent's non-verbal responses, such as body language.
   - Writing an effective survey can be very time-consuming.

Fixed format questions might be chosen when questions are straightforward and additional information is not necessary, and/or when you must be able to compile the results quickly, but have a large number of people to survey.

Free-format questions might be chosen when it would be useful for respondents to be able to 'build' on their answers, or when the questions are open-ended and compiling the results is not an issue.

A question may allow for both; respondents must answer the fixed format section, but are also given the opportunity to expand their answer in a free-format comment section.

One method of determining a questionnaire's effectiveness is to first test it on a small group of representative respondents for clarity, consistency of understanding and usefulness

11. JRP can be used to reduce the number of interviews during requirements discovery, which can save considerable fact-finding time, particularly on large projects. JRP can also be an extremely effective method to have users and management take ownership. JRP is also particularly beneficial when prototyping is employed to confirm requirements and to obtain group consensus on design.

    Selection of users and managers should be based on relevant business knowledge and their commitment to active involvement and making a meaningful contributing to the JRP sessions. The project sponsor is generally responsible for selecting the system users and manager who will participate.

    Facilitators should have strong organizational skills, be able to communicate well, know how to negotiate and resolve conflict, understand the business of the organization, and above all, to remain impartial. In order to capture and generate information effectively, scribes should be knowledgeable in systems analysis and design, and be skilled in using CASE tools.

    The role of IT staff during JRP sessions is primarily to listen rather than actively participate, to address concerns to the facilitator outside of the meeting, and to address technical issues when requested to do so by the facilitator.

    The typical duration of a JRP session ranges from several days up to two weeks on occasion.

12. 1) Selection of the right system users and managers for the JRP sessions.
    2) Participants' understanding of and adherence to their respective roles
    3) Full support of the project sponsor to committing time and resources to the JRP sessions, and to requiring that key members of the user community attend.
    4) The abilities of the facilitator and scribe

    5) Determining prior to the JRP sessions the project scope, high-level requirements and expectations.
    6) Preparing an agenda for each JRP session
    7) Conducting the JRP session effectively

13. No matter how tempting, what the analyst should not do is to jump in and start interviewing or using other fact-finding techniques without first developing an overall fact-finding strategy. To start interviewing without a plan, for example, wastes not only the analyst's time, but to waste the time of the users and to squander the resources of the organization. In general, as many facts as possible should be collected using other methods before interviewing users.

Project and Research

1. Response is open-ended, but look for a diagram that is consistent with the fishbone diagram shown in the textbook, and for responses to the other questions which indicate that the student understand and used this diagram as a genuine problem-solving technique.

2. Work observation and work sampling plans can encompass a wide range of procedures and techniques, but should be consistent with the guidelines described n the textbook. Responses should also indicate that student understands when work observation is appropriate and when other methods might be used instead.

3. a. Response can be fairly open-ended, but should reflect the typical questions one would ask employees at all levels regarding the content and features that would be useful to them or to other employees and staff in an intranet.

   b. Given the size of the organization, a sampling of employees would be more appropriate than a census. The sampling should be stratified on the basis of employee function and level (both management and rank-and-file) to ensure proportionate representation, and should be of sufficient size to ensure validity.

   c. Given the subject matter and objective of this questionnaire, it should include both free-format and fixed-format questions.

  d. The survey should take no longer than 5 – 10 minutes to complete. The free-format questions should be able to be answered in three sentences or less.

  e. Survey questionnaire should elicit the facts and opinions to be collected per the preceding questions. Questions should not have construction errors, should be clearly and carefully worded to avoid misinterpretation and should avoid possible personal bias.

4. a. Either type is acceptable, but unstructured would probably be more appropriate, given that in this situation, your questions will tend to be more general and open-ended in order to give the administrator wide latitude in responding.

  b. Open-ended, but should be applicable to subject of interview.

  c. Interview guide should be similar to the format of Figure 6-3, questions should be comprehensive and should not be loaded, leading, biased or ambiguous, and time allocated should be proportional and not exceed 30 – 45 minutes maximum.

  d. Responses should not be rote or perfunctory, and should indicate that interviewer attempted to elicit sufficient information where necessary.

  e. Open-ended, but self-assessment should be thoughtful and perceptive.

5. Responses are open-ended, but should be thoughtful and indicate that student made a genuine attempt to observe the impact of body language upon the interview process.

6. Responses to Questions 6a – 6d can be open-ended, but should be thoughtful and indicate that student understands the scope of ethical issues and violations, the circumstances that can lead to them, the consequences, and their own personal responsibility. Question 6e should also cite the need for ongoing ethics training, and the need to document ethics policies in a policy memorandum or manual.

Minicases

1. Note to Professor: Example questions:

  • Would the employee work more (or less) hours if they have the opportunity to work at home?

- How much?

- How long does the employee usually travel in a commute to work?

- If they didn't commute to work everyday, would they be willing to "donate" part of that saved time to their employer?

2. An example question will be:

    Each day, how many minutes do you travel each way to work?

    a. 1-10   b. 11-20   c. 21-35   d. over 35

    We use an anonymous survey to minimize our influence on employee answers.

3. The choice of open-ended or closed questions will be determined by the student's existing knowledge of a registration system, and the stakeholder groups' needs. If the student has adequate existing knowledge, they can proceed directly to a closed question. If not, they will begin at an open-ended question design.

    Example open-ended question: What do you particularly like/dislike about our current online registration system?

4. We expect to get different results. Discuss with students the importance of minimizing interviewer and question bias.

Team and Individual Exercises

1. There is no answer to this question.

2. Note to professor: Obviously, we are not trying to teach a class to bias interview results. But, a fun skit or parody can help them realize the importance of their behavior on an interview. Let this one be a comedy...

3. There is no answer to this question.